TRADE LIBERALISATION IN SMALL OPEN ECONOMIES: THE CASE OF KENYA

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ABSTRACT

The object of this thesis is to determine the consequences of trade liberalisation on the Kenyan economy. This is done by simulating the effects of tariff reduction, devaluation of domestic currency and export subsidies. In addition, the effects of quantitative controls and markup pricing are simulated. The structure of the economy is modelled through the specification of alternative closure rules.

Policy changes are simulated using a computable general equilibrium model (CGE). A nine sector model based on a Social Accounting Matrix is constructed using the TV-approach to modelling introduced by Drud, Grais and Pyatt (1986). We depart from neoclassical models, and therefore other CGE models of Kenya, by assuming product differentiation between domestic goods and imports and between gross output sales to domestic and export markets. Our model is essentially Keynesian but for comparative purposes, neoclassical closures are specified in some simulations.

In general, the basic argument for or against trade liberalisation concerns its contribution to economic growth. The neoclassicals argue that by improving efficient allocation of resources, liberalisation stimulates higher economic growth. The structuralists, on the other hand, argue that because of structural rigidities in LDC economies and because of unfavourable international conditions, liberalisation will have minimal effect on economic growth. CGE models are useful in sorting out these arguments. It should be noted however that the assumptions underlying these models often reflect the modeller's view about the structure of the economy. The usefulness of CGE models for policy purposes will therefore depend on how realistic they reflect the structure of the economy being modelled.

The results of our model show that the gains from trade liberalisation, in terms of the growth of real GDP, are low. This applies to both neoclassical and Keynesian closures. However, it is shown that changes in returns to factors, consumption levels and aggregate price levels, depending on the closure adopted, are significant. This is also true for the policy effects on exports, imports and on the prices and quantities at the sectoral level. These results reinforce the view that for policy purposes it is important that the model being used reflects the structure of the economy under consideration. It also means that it will not make sense to have tailor made policy recommendations for all LDCs.

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CHAPTER ONE

INTRODUCTION

The purpose of this thesis is to evaluate the consequences of economic liberalisation on the Kenyan economy. This is done by simulating the effects of tariff reductions, devaluation of domestic currency, export subsidies and the relaxation of quantitative restrictions. Our interest is not only to determine the effects of these policy changes on macroeconomic aggregates; but also their effects at the sectoral level. The empirical results, obtained using a computable general equilibrium model (CGE), are then compared with the predictions of trade theoretic models, which normally form the basis for policy recommendations to LDCs.

Strictly speaking economic liberalisation encompasses more than the trade policy instruments listed above. In the context of the current orthodoxy, liberalisation primarily involves a movement towards less control of factor markets, financial (including foreign exchange) markets and commodity markets. Less participation of governments in economic activities, together with lower public expenditures are also advocated.

Economic liberalisation also involves the use of stabilisation policies (such as fiscal, monetary and exchange rate policies) to maintain, or bring the economy in disequilibrium back into, internal and external balance. Some of the parameters to be targeted in this case include aggregate demand, public sector deficits, inflation and the balance of payments deficits.

In the wider sense, economic liberalisation therefore involves efforts to move the economy towards some desired equilibrium, and the removal of distortions in the domestic markets as well as the external sector. The basic argument for liberalisation is the notion that it leads to efficient allocation of resources and hence higher economic growth. It is also based on the belief that the private sector is a more efficient resource user than the public sector.

The increased concern for economic liberalisation in LDCs in the last two decades is not accidental. The enormous economic problems faced by LDCs during this period have dictated the need for urgent solutions. To evaluate the nature of these problems and the attempts to solve them requires a historical perspective of the type of development policies followed. It is also necessary to understand the underlying structure of LDC economies. This is because the causes of economic stagnation and the policies necessary to generate growth in LDCs are highly disputed.

In the 1950s and 1960s, LDCs were preoccupied with efforts to attain fast and sustained economic growth. Spurred on by theories which emphasised the importance of industry in development, these countries promoted industrial development through import substitution (ISI) policies. The instruments used to promote these polices were in fact trade related; and in particular tariffs and quantitative restrictions. Industrial policies therefore came to be synonimous with trade policies. Industrialisation was also promoted through public investments.

In many instances substantial economic growth followed the implementation of import substitution policies. In fact the success of these policies in the 1960s led to observations that the benefits of economic growth was not "trickling down" to the poor. This created a new school of thought which argued for a basic needs approach to development. This approach called for implementation of development strategies which directly addressed the issue of income inequality.

The response of LDC governments to these recommendations was to get more involved in economic activities. Increased public sector employment and provision of social services were also used in attempts to influence poverty directly. The increase in public expenditure associated with these policies was to become a major issue in economic liberalisation process.

The economic performance of LDCs, together with much of their concerns for income inequality, were severely negated by the economic crises of the 1970s and 1980s. The oil crises of 1973/74 and 1979/80 adversely affected LDC economies in several ways. Firstly, the cost push effects arising from higher import prices disrupted the production process. This was made worse by import compression which LDCs had to use to deal with the balance of payments deficits. Secondly, the oil crises also led to a slow down in developed economies, resulting in the reduction of imports from LDCs. Overall, non-oil LDCs experienced large deterioration in their terms of trade.

Although non-oil LDCs suffered the most from the oil crises, some oil exporting countries were also adversely affected through the so-called "Dutch disease". This phenomenon is used to explain the negative effects associated with a boom in exports of resource-based and/or primary products. For example, an increase in the exports of such commodities shifts resources from tradable sectors to non-tradables. The result is not only a reduction in the production of tradables, but also a decline in export performance. It is similarly true that the benefits of the commodity booms of the mid-1970s were mitigated by the Dutch disease effects.

Another effect of the price increases of 1973/74 was to increase international financial liquidity. This resulted in lower real interest rates and therefore increased borrowing by LDCs. By the early 1980s the level of indebtedness was so high that many of these countries found it difficult to service their debts. When some countries started defaulting in 1982, access to international capital by LDCs began to diminish. This deepened the economic slowdown, and therefore increased demands for the restructuring of LDC economies.

Kenya's development path after independence in 1963 has been typical of the types described above. It started with a vigorous ISI strategy based on private and public investment. The first decade (1964-73) was marked by rapid economic growth. GDP at factor cost grew at an annual rate of 7%; with manufacturing and agriculture sectors growing at 9% and 4% per annum, respectively. The importance of the public sector is indicated by the fact that it grew by over 10% per annum over the period. This high growth is attributable to protection and high domestic and foreign demand.

Like other LDCs, Kenya's economy suffered from the negative effects of the external shocks of the 1970s. To some extent it is true that even before the oil shocks, some underlying weaknesses of the economy were already beginning to show up. The expansionary monetary and fiscal policies started in the late 1960s led to a foreign exchange crisis in 1971. This was dealt with through foreign exchange and import controls with resulting negative repercussions on the economy. By the late 1960s the "easy phase" of ISI policies were coming to an end. As a result economic liberalisation began to be advocated (see for example, Hopcraft (1972), Power (1972) and World Bank (1975)) as an alternative method of stimulating economic growth and export performance. On the other hand, the ILO (1972) concluded that the economic growth of the first decade had not been equitably distributed. The report therefore argued for increased government involvement in the economy to redress the income inequality.

It is without doubt however that the external shocks played a major role in the deterioration of Kenya's economy in the 1970s and 1980s. The effect of the first oil crisis was so severe that Kenya was among the first countries to benefit from the extended IMF facility in 1975. The economic growth declined from the high levels of 1964-73 period to 3.0% per annum. The commodity boom of 1976/77 helped to moderate the decline in the economy. The second oil crisis of 1979/80 however led to a further decline in Kenya's terms of trade and together with international recession depressed the economy. Between 1980-85, GDP at factor cost declined by 1%, and manufacturing and agricultural sectors declined by 1% and 2%, respectively.

To deal with external shocks and the accompanying economic problems stabilisation and liberalisation programmes have been implemented. These have included restrictive monetary policies, reduction in public expenditure and a host of trade policy changes including devaluation, tariff reductions and relaxation of quantitative restrictions. Import compression which has always been used to deal with balance of payments deficits has remained the most potent component of the control system despite its perverseness. The most comprehensive policy changes were linked with the 1979/80 standby arrangements and structural adjustment agreements with the IMF and World Bank, respectively.

The consequences of these policies have been evaluated in Killick (1984), Mosley (1986), Van der Hoeven and Vandemoortele (1987), Godfrey (1987) and Ikiara (1988). None of these studies however makes an attempt to quantify the policy effects.

There are several CGE models of the Kenyan economy. Roe and Pal (1986) simulate the effects of the external shocks associated with the two oil crises, while Bevan et al (1987) and Gupta and Togan (1984) simulate the consequences of the commodity boom of 1976/77. These models however only indirectly incorporate trade issues. Blomqvist and McMahon (1984) is the only study that explicitly simulates trade policy changes using Kenyan data. The results of this model are limited by the fact that it is a two sector model; it also incorporates many classical features which are inappropriate in modelling LDC economies.

Our model differs from most of the above models because it concentrates in simulating the effects of trade liberalisation. And unlike Blomqvist and McMahon we depart from the two sector textbook type model by specifying a truly multisectoral model. The advantage of a highly disaggregated model is that it reflects dynamic interactions in the economy in a much more realistic way. This is especially important since we are interested in the effects of trade policy changes on resource allocation. Our model also incorporates features which reflect the Kenyan economy in the most realistic way. This applies to the modelling of factor markets, product markets and especially the external sector. The consequences of import controls and markup pricing are simulated. The other novelty of our model is the assumption of product differentiation between domestic goods and imports and between the gross output sales to domestic and export markets.

An outline of the rest of the Chapters is shortly presented. We first note that the HERCULES representation of our model is appended to the end of the thesis. This appendix shows how the model has been specified, parameterised, and then calibrated. It contains both a base solution and a model solution, with a short summary of their interpretation. Our model can therefore be easily replicated.

Chapter Two provides a review of Kenya's trade policies, including their evaluation and implications. A review of the pattern and direction of external trade is also provided. In the process the importance of external trade to Kenya's economy is analysed. The Chapter also analyses the overall growth of Kenya's economy. An attempt is made to link the performance of economy with trade policies. A historical review of the trade liberalisation programmes started in the mid-1970s is provided. This includes details on the implementation of specific policies and the problems and/or successes of the programmes.

Chapter Three reviews the modelling of LDC trade policies. An attempt is made to compare the implication of the application of classical trade models to LDCs with the "new" models. New models here are taken to be those which incorporate product differentiation between domestic and foreign goods; as compared with the classical models which assume perfect substitutability. Qualitative analysis of trade reform is made with the use of a two-sector model with sector-specific capital. The Chapter also provides a literature review of CGE trade models applied to LDCs. The few applications to Kenya are given greater emphasis.

In Chapter Four the model to be used in our empirical analysis is developed. The Chapter begins with the presentation of the data. The transformation of the original SAM data to fit our modelling purposes is discussed. Thereafter, a formal model is developed using the TV-approach introduced by Grais, Drud and Pyatt (1986).

Chapter Five presents the base solution of the model. However, before the model is calibrated the required parameters are shown, with discussions on how or where they are obtained. The sensitivity of the model results to these parameters, especially the elasticities, is carried out. The Chapter also discusses the issue of closure rules. A model by Sen (1963) is used to distinguish among the various types of closure rules. The implications of the closures rules in the determination of model results are simulated. It is argued in this Chapter that the Kenynesian closure (model) is the most appropriate for use in our empirical analysis.

The empirical results of our model are presented in Chapter Six. Lastly, Chapter Seven contains the conclusions of the thesis.

CHAPTER TWO

KENYA'S TRADE POLICY REGIME SINCE 1964

2.0 Introduction

This Chapter reviews Kenya's post-independence trade policies. Emphasis is placed on the origin and the evolution of these policies. This provides the background necessary for the understanding of the process of trade liberalisation. This line of analysis also highlights the implication of trade policy changes on the economy. The link here lies in the long standing debate about whether trade is an engine or handmaiden of economic growth in developing countries (LDCs). Those involved in the debate, initially started by Nurkse (1961) and Kravis (1970), can be categorised into two camps: namely, the "pessimists" or structuralists and the "traditionalists" or classicals.

The postulate that trade is an important determinant of development dates back to the last century. This argument follows from the classical, Hecksher-Ohlin-Samuelson (H-O-S), trade theory conclusion that countries maximise their welfare by trading in commodities with which they have a comparative advantage in production. This view however began to be challenged by the pessimists in the 1950s and the early 1960s. This challenge came from the various strands of pessimists, notably the terms of trade school of Singer (1950), Prebisch (1950, 1959) and Myrdal (1959); the dependencia school of Frank (1978); and the unequal exchange school of Emmamuel (1960).[1/] The main argument against the application of the H-O-S model to LDCs is that it implies specialisation in the production and export of primary products, and hence the reallocation of resources to the sectors of the economy which are not dynamic. It also implies continued dependence by the LDCs on imports of manufactures and essential intermediate inputs from developed countries. Taken together, the two arguments are used to reach the conclusion that the H-O-S model creates and perpetuates the unequal exchange between developed and developing countries. It is also argued, that LDCs cannot depend on export-led growth because of deteriorating barter terms of trade, as well as recessions and increased protectionism in the North. These arguments have led to such policy recommendations as greater North-South dialogue, the use of international agencies like the UN and GATT to negotiate for increased exports of LDC manufactures to developed countries, South-South cooperation, and development policies which emphasise self reliance.

The major consequence of the pessimists challenge is that most LDCs adopted trade policies at variance with the theory of comparative advantage. These have mainly been import-substitution industrialisation (ISI) policies aimed at diversifying away from exports of raw materials. Ironically, to finance ISI projects LDCs have had to intensify their position as exporters of raw materials and cash crops.

In most LDCs the first few years of ISI policies were successful. However, once the "easy phase" was passed the high hopes of faster economic development, increased export of manufactures, and less reliance on exports of raw materials began to fade.[2/] The classic examples of such phenomena are to be found in Sub-Sahara Africa, where economic stagnation and in many instances declining economic growth is a serious problem. These countries are at the same time burdened with high external indebtedness and chronic balance-of-payments problems.[3/]

With the decline in LDC economies the inward-looking ISI policies began to be questioned in the late 1960s and early 1970s. Several country studies, summarised in Little, Scitovsky and Scott (1970), Bhagwati (1978), Krueger (1978), and the studies by Balassa (1978, 1985) among others, conclude that poor export performance in LDCs is a result of inappropriate trade policies. In particular, these studies argue that ISI policies are distortive, anti-export and hence in the long run anti-growth. This has led to recommendations of policies which aim to promote domestic economic efficiciency and increased production for export. These recommendations have in general called for less government involvement in the economy, relaxation of trade restrictions and exchange controls, and the maintenance of "realistic" exchange rates. In many respects the economic decline in many LDCs in the 1970s and 1980s has lent more weight to the advocacy of these policies. Indeed, the economic liberalisation policies undertaken by LDCs under the IMF-World Bank programmes are inspired by the export promotion paradigm.

The current dominance of outward looking trade policies does not suggest that the debate on the role of trade in development has been resolved. A series of studies which attempted to address this problem failed to produce a unanimous conclusion. Michaely (1977), Balassa (1978), Tyler (1981), and Feder (1983) found a significant correlation between export performance and economic growth; but Love

(1984) and Taylor, McCarthy and Alikhani (1984) established the correlation between exports and growth to be weak. The view that export-led growth may not be a viable alternative in LDCs still persists.

2.10 Kenya's Trade Policies

Before examining Kenya's post-independence trade policies, a brief sketch of the colonial policies is provided. One thing that should be noted is that before and for sometime after independence tariff policies were under the control of the East African customs union. This only changed with the collapse of the East African community in 1977. The loss of the independent use of tariffs as trade policy instruments by Kenya encouraged increased use of quantitative restrictions in the 1970s.

The main purpose of colonial trade policies was to raise revenue and to a lesser extent to protect the domestic consumer goods industries. For these reasons tariffs and specific duties were the major trade policy instruments and there were almost no import controls. In 1962 six types of duties were applicable: (1) a luxury rate of 66.3% on luxury imports, (2) protective rate of 33.3% on competing imports, (3) a general rate of 25% whose goal was to raise revenue although used for protection where domestic production existed, (4) motor vehicle rate of 15%, (5) a general assisted rate of 12.5% which was a reduction in the general rate with the aim of stimulating domestic production, and (6) a list of duty-free items, mainly machinery and raw materials essential for domestic production (IBRD, 1962, pp.159-160). Specific duties were also used to collect revenue and partly to increase the level of protection of domestic industry. Suspended duties, which could be used for protection when necessary, also existed. Other policies used to promote domestic production and exports included low export taxes and railway tariffs, and duty drawbacks and remissions.

The period preceding independence in 1963 was one of high uncertainty. With the economy controlled by European settlers and foreign firms the reality of impending independence led to high capital flight and hence low capital formation. This resulted in a major economic stagnation which began in the late 1950s. As part of a program to promote industrial growth, limited import licensing began to be used in 1958.

2.11 Post-Independence Policies

The efforts made to stimulate the economy in the late 1950s proved unsuccessful. Kenya therefore entered the independence era under depressed economic conditions and urgent steps were necessary to rejuvenate the economy. The policies initially implemented were adopted from a 1962 World Bank mission which recommended that Kenya encourage the growth of the industrial sector by means of tariffs, duty drawbacks, quotas, and subsidies.[4/] These ISI type policies, as outlined in the first Development Plan (1966-1970), had the stated objectives of raising the standard of living for Kenyans; enhancing technical progress; increasing the domestic value of domestic products; and promoting export-oriented industries.[5/] These policies were restated in the 1970-1974 Plan which advocated increased protection "by use of import licensing, quantitative restrictions, and by duty drawbacks on imported raw materials".[6/]

The use of tariffs and quantitative restrictions as tools for protection is discussed in the next two sections. The perverseness of these policies and their implication on the economy is analysed. However, no attempt has been made to quantify their effects.

2.12 Tariffs

The structure of Kenya's post-independence tariff system has not been widely examined. The few studies which have been done confirm that the system has been of the type associated with ISI policies. While the tariff schedule contained 177 items in 1962 (IBRD, 1962, p.159), these figures had increased to 1416 and 2741 items (Sharpley and Lewis, 1988, p.45) in 1970 and 1984, respectively. Sharpley and Lewis (1988) also show that from 1964 to the middle of the 1970s average duties on intermediate and capital goods were constant and low, averaging about 20%; while those on consumer goods averaged about 35%. This pattern changed in the early 1980s when the average tariff rates on consumer goods began to decline rapidly while those on capital and intermediate goods rose above 20%. The effect of this change was to create some degree of uniformity. The former pattern of tariff structure conforms to the governments policy of trying to promote domestic industry through heavy duties on consumer goods and lower rates on capital and intermediate inputs. The later pattern, as we shall discuss later, is indicative of trade liberalisation policies of the 1980s which called for a move towards uniform protection.

As is now well known, the most appropriate measure of the protective effect of tariffs is not the nominal rate, but rather the effective rate. This is the extent to which tariffs protect the domestic value added. Studies on the effective rate of protection (ERP) of Kenya's industries are sparce. Some of the studies which have estimated this measure are Reimer (1970), Phelps and Wasow (1972), Grosh (1987), and IBRD (1987).[7/] While the results of these studies differ in magnitude, their rankings of effective protection are remarkably similar. For instance, their estimates of ERP for consumer goods are quite high, while those of intermediates and capital goods are low and in many cases negative. The average overall effective rate of protection in 1968 was estimated by Phelps and Wasow (1972) to be 34.2%. Comparing this figure with the 51.0% obtained by IBRD (1987), Sharpley and Lewis (p.60) conclude that this suggests an increased level of protection in the 1980s. Since the two studies are not comparable the conclusion seems to be far fetched. While it is possible that the level of protection was higher in the 1980s than the 1960s, this cannot be inferred from the two different levels of ERP.

2.13 Quantitative Restrictions

Import controls have been used as instruments of industrial protection in a variety of ways. The most common have been quota restrictions, total bans, approval to import certain products allowed only to specific agents or after obtaining special permission from specific government bodies, and a requirement of "non-objection certificate" (basically permission to import) from the producers of the domestic competing product.

It would appear that despite the intent of the first two development plans, no serious effort was made to use quantitative restrictions for protection during the covered periods. The same licensing system, with only 19 items on it, was in operation between 1964 and 1972. However, with the foreign exchange crisis of 1971 import controls began to be used also for exchange control purposes. The increased protective nature of the system resulted not only from the increased number of items under license, but also because import bans and quota restrictions were imposed on items which were previously freely imported. The import licensing system introduced in 1972 had five schedules: A, B, C, D, and E; of which D and E contained items which were freely imported before (IBRD 1975, pp.294-297). Schedules B and E contained banned items, while items in schedules C and A could only be imported conditional on approval by commercial banks after exchange controls and administrative requirements had been met, and those in D could only be imported prior to obtaining a "no objection to foreign exchange" certificate from the government. Under this system the number of licensed items rose to 369.

As the foreign exchange position improved, the controls began to be relaxed. In 1973 the number of imports under license was reduced to 205 (IBRD, 1975) and a new licensing system was introduced. This system remained in place until it was replaced by one introduced under the structural adjustment programme of 1980. The 1973 licensing system had four schedules: (I) which listed items which could be imported subject to specific licenses, but for which foreign exchange was readily available; (II) listed imports under quota restrictions; (III) listed banned imports, some of which however could be imported after obtaining a "non-objection certificate" from the domestic producer; and (IV) which listed imports under quota restrictions for balances of payments purposes. Subsequent changes to the system before 1980 only involved the shifting of items among the schedules or changing the number of items in each schedule. For example, the system was tightened up in response to the external shocks in 1973/74; resulting in more than doubling of licensed items to 472 in 1975. Similarly, the export boom of 1976/77 led to the relaxation of the controls. This generated an import boom in 1978 which in turn led to a balance of payments crisis leading to the imposition of import controls in 1979. The structure of the import control system introduced in 1980, but published in 1981, and those of later years is shown in Table 2.8. It is clear that as the import licensing system became a prominent trade and exchange control policy instrument the number of licensed items increased.

There have been only a few studies on the protective effects of the Kenya's import controls system. To estimate ERP Phelps and Wasow (1972) and Grosh (1987) used direct comparisons between domestic and world prices; where world prices are defined as import prices inclusive of duties, sales taxes and handling costs. The difference between the two prices can be interpreted as an implicit tariff (premium) and hence represents the price effects of quantitative restrictions. Grosh (1987) estimates the premiums earned by domestic producers ranging from an average of 13 percent by public sector firms to 16 percent by the private sector firms. Hopcraft (n.d.) has made an attempt to quantify the price effects of import controls for a number of items. Using firm specific data he found that domestic producers of paper products earned premiums between 72-113%; while producers of pharmaceuticals earned premiums between 31-213%. While the coverage of industries in Hopcraft's study is limited its results point to the fact that quantitative restrictions generate high premiums.

The protective effect of both tariffs and import controls can be examined by looking at the pattern of the end use analysis of imports. Table 2.1 shows that protection has been very effective in reducing the proportion of consumer goods in total imports from 34 percent in 1960 to 12 percent in 1986. However, it has had minimal effect on the imports of intermediate and capital goods. The dependence on imports of these two types of goods has increased over time. This is not surprising given the low level of effective protection given to the industries producing these goods. The implication of this result is that one of the objectives of the protection policy; namely, that of increasing the utilisation of domestic resources was undermined.

2.20 The Kenyan Economy

As argued before, the goal of ISI policies was to promote faster and sustained economic growth. A high growth of the manufacturing sector was considered essential for increased employment, domestic value added, and production for export. Below we briefly sketch the pattern of Kenya's economic growth for the period 1964-85. No serious attempt is made to critically analyse the sources of the changes in the observed growth patterns.

TABLE 2.1

End Use Analysis of Imports as Percentage of Total Imports

	Consumption	Intermediates	Capital
1960	34	39	27
1964	27	58	15
1965	26	61	13
1966	27	57	16
1967	22	56	22
1968	24	58	18
1969	23	60	18
1970	23	58	19
1971	24	56	20
1972	22	55	22
1973	18	62	21
1974	13	72	13
1975	15	67	18
1976	18	63	19
1977	15	61	25
1978	15	55	29
1979	15	63	22
1980	15	70	15
1981	20	58	22
1982	16	61	22
1983	17	61	22
1984	14	64	22
1985	14	64	21
1986	12	55	29

Source: Statistical Abstract (various issues).

2.21 Sectoral Growth of GDP

As shown by Table 2.2, the Kenyan economy is dominated by the agricultural sector. The relative importance of this sector has however been declining over the years. The share of the private monetary service sector in real GDP is high and has since 1979 supplanted agriculture as the leading sector. On the other hand, the share of the manufacturing sector has marginally changed over the years. The World Bank (1962) shows that during the 1950s agriculture and manufacturing sectors contributed about 40 and 10 percent of GDP respectively. This suggests that apart from the changes in the

TABLE 2.2

Percentage Shares of Real Monetary GDP (1980 Constant Prices)

	Agriculture	Manufacturing	Private Services	Government Services
1964	45.00	9.64	32.37	12.98
1965	40.20	10.82	35.49	13.49
1966	42.97	10.23	34.01	12.79
1967	41.38	10.51	34.73	13.77
1968	39.10	10.64	35.40	14.86
1969	38.25	11.25	35.02	15.48
1970	37.63	11.30	35.80	15.28
1971	35.36	11.89	35.43	17.32
1972	36.20	12.12	34.46	17.21
1973	36.32	12.78	34.62	16.28
1974	35.46	13.00	36.35	15.18
1975	34.68	12.72	36.37	16.23
1976	38.55	11.92	34.25	15.27
1977	42.79	11.48	31.93	13.80
1978	37.34	12.96	34.88	14.82
1979	34.68	13.35	36.51	15.46
1980	32.54	13.96	37.78	15.72
1981	32.39	13.43	38.19	15.99
1982	32.47	13.33	38.41	15.80
1983	32.66	12.94	39.34	15.06
1984	31.37	13.34	39.94	15.35
1985	30.74	13.29	40.56	15.41

Original Source: Statistical Abstract (various issues) and Vandermoortele (1985).

agricultural sector the structure of the economy has only marginally changed since independence.

The development process in the post-independent Kenyan economy can be divided into three phases; Phase I: (1964-73) can be called the development decade because it is associated with high economic growth; Phase II: (1974-79) can be called the disruption period because during this period the economy experienced external shocks arising from the oil crises of 1973 and 1979 and the commodity boom of 1976-77; and Phase III: (1980-85) is the structural adjustment period because it coincides with a period in which stabilisation and liberalisation policies were used in an attempt to rejuvenate the economy.

The growth rate of real GDP (at factor cost) and its various components for the different periods are given in Table 2.3. Over the period 1964-85,real GDP grew by 3.17 percent per year, while agriculture and manufacturing grew at an annual rate of 1.86 and 4.77 percent respectively; the two service sectors grew at about 4% per annum. These do not appear to be spectacular growth rates for a country normally considered a success story in Sub-Saharan Africa. However, a different picture emerges when economic performance during the different sub-periods is examined. During the development decade high real GDP growth rates were achieved, with manufacturing and Government services leading the way at over 9 and 10 percent per year, respectively.

These impressive growth rates would seem to be in line with those associated with the "easy-phase" of ISI type policies. The role of industrial protection is clearly reflected in the high growth of the manufacturing sector. On the other hand, the increased role of the government in the provision of social services and infrastructure explains the growth in public sector services. The 4.1% increase in the growth of the agricultural sector though relatively lower than those of other sectors is significant because of its prominence as the leading sector in the economy.

The second phase (1974/79) exhibits a less rosy picture as real GDP grew by half the previous rate. This pattern of growth resulted from external shocks of the period. The balance of payment problems of 1974/75 and 1978/79 resulted in import compressions which

TABLE 2.3

Growth of Real Total GDP and its Major Monetary Components
(Annual Growth Rate)

	1964/ 1985	1964/ 1973	1974/ 1979	1980/ 1985	1980	1981	1982	1983	1984
GDP	3.17	6.58	2.76	-1.18	-3.38	3.49	-6.22	1.01	0.90
Agriculture	1.86	4.08	3.16	-1.61	-6.77	2.91	-4.52	1.93	-4.52
Manufacturing	4.77	9.46	2.99	-1.38	3.84	-0.34	-6.80	-1.15	2.57
Private Services	4.02	7.05	2.02	0.93	2.80	4.51	-4.55	3.64	0.97
Government Services	3.89	10.35	1.70	-1.31	0.91	5.12	-6.30	-3.36	1.58

Source: As in Table 1.

tended to retard economic growth primarily because of the economy's heavy reliance on imported capital goods and intermediate inputs. The negative effects of the external shocks were to some extent moderated by the positive effects associated with the commodity booms of 1976/77. This is reflected by the relatively lower decline of the agricultural sector.

The economic performance during the adjustment period was quite dismal. This was largely due to the poor weather conditions in 1980 and 1984 which drastically reduced the growth rate in agriculture; and the balance of payments crises of 1980 and 1982. The dominance of the agricultural sector in the economy can again be seen from the impact of the negative growth of this sector on GDP in 1980 and 1984. The crisis management associated with the balance of payments crises is also evident from the gyration of real GDP growth between 1980-84. The negative growth of government services is attributable to the usual policy of reducing the public sector under structural adjustment programs.

2.22 Pattern and Direction of Trade

In the previous section the performance of the Kenyan economy was linked to conditions in the international economy. The assumption behind this assertion is that Kenya is a highly open economy. This assertion is confirmed by Table 2.4 which shows that total merchandise trade has over the years averaged above 40 percent of real GDP. The table also shows that the barter terms of trade declinded sharply in the 1980s. The openness of the Kenyan economy leads to the conventional assertion that it is prone to fluctuations in the international economy. This claim is in fact made by Van der Hoeven and Vandermoortele (1987) who find a high correlation between

TABLE 2.4

Exports and Imports as a Percentage of Real GDP (1980 constant prices) and Barter Terms of Trade (TOT)

	TOT	EXPORTS	IMPORTS
1964	147.06	21.03	23.29
1965	141.18	21.77	26.92
1966	141.18	20.75	28.10
1967	141.18	17.31	24.23
1968	147.06	17.47	24.87
1969	138.89	17.71	23.44
1970	150.00	18.05	26.18
1971	130.00	16.81	29.97
1972	122.73	17.64	26.30
1973	123.08	20.45	25.87
1974	107.69	21.76	35.44
1975	96.00	19.55	29.81
1976	112.07	23.35	27.55
1977	148.39	26.53	28.09
1978	118.18	18.88	31.55
1979	109.21	17.80	26.71
1980	100.00	19.13	35.58
1981	85.94	17.36	29.90
1982	81.63	16.27	25.91
1983	77.13	16.55	22.98
1984	89.64	18.65	26.76
1985	75.00	16.38	24.53

Source: Statistical Abstract (various issues).

Kenya's annual growth of real GDP and the terms of trade.

The commodity concentration of exports is shown by Table 2.5. During the colonial period, as it still is today, coffee was the major export earner. Together with sisal and tea, coffee contributed over 40 percent of total export earnings. Commodity concentration has however increased over the years. While the share of sisal had declined to about two percent of total export earnings by the middle of the 1960s, exports of petroleum products began to play a major role. The contribution of petroleum exports to the economy is however doubtful as the sector contributes little to domestic value added. Since Kenya is not an oil producer, the petroleum exports are largely

TABLE 2.5
Major Commodity Exports as Percentage of Total Exports

	Coffee	Tea	Petroleum
1950	16.8	6.3	-
1955	28.1	8.8	-
1960	21.0	9.0	-
1964	32.7	12.9	4.6
1965	29.9	12.9	9.9
1966	32.3	15.0	10.1
1967	29.3	13.8	13.8
1968	22.2	17.4	10.8
1969	26.6	17.8	12.0
1970	21.6	12.8	13.4
1971	18.1	13.4	14.1
1972	20.1	13.4	12.4
1973	22.2	10.5	10.0
1974	18.2	9.2	18.0
1975	16.4	10.7	22.6
1976	29.3	10.0	17.9
1977	42.5	14.9	15.1
1978	33.7	17.1	16.3
1979	28.7	16.3	17.7
1980	22.2	11.9	31.1
1981	21.3	11.9	30.7
1982	26.5	14.2	26.0
1983	25.3	19.5	19.5
1984	27.0	25.1	17.4
1985	29.7	24.7	14.0

Source: Statistical Abstract (various issues) re-exports of refined products. Nonetheless, by the 1980s tea, coffee and petroleum accounted for 60 percent of total export earnings.

The geographic concentration of exports is shown in Table 2.6. It is shown that during the 1960s and early 1970s East African countries and Britain were the main markets for Kenya's exports. Together, these countries imported over 40% of Kenya's exports. From the middle of the 1970s this concentration began to decline.

The decline in Kenya's exports to East African markets is attributable to the collapse of East African Community in 1977 which reduced exports to Tanzania below 1% of total exports. However, it is evident that the decline of exports to the East African markets have to some extent been made up by increased exports to other African markets.

The high openess of Kenya's economy together with the high commodity and geographic concentration of Kenya's exports exposes the economy to fluctuations in international markets. The poor economic performance of the last two decades can therefore be attributed to cumulative effects of the external shocks and the deterioration of the international commodity markets. The World Bank (1983), Roe and Pal (1986) and Van der Hoeven and Vandermoortele (1987) arrive at this conclusion. However, it has long been argued, starting with studies by Phelps and Wasow (1972), Reimer (1971), Power (1972), Hopcraft (1972, mimeo) and World Bank (1975), that high protectionism also adversely affected the economy. In fact it can be argued that the debate on the need for a liberal trade regime generated by these studies stimulated the movement towards trade liberalisation in the middle of the 1970s.

TABLE 2.6

Direction of Real Exports (Percentage of Total by Destination)

	United Kingdom	West Germany	USA	Tanzania	Uganda	Rest of Africa*
1960	11.41	12.09	7.30	14.62	11.41	5.01
1961	12.22	10.16	8.70	25.93	12.22	5.20
1962	11.69	11.97	6.00	16.54	11.69	5.19
1963	13.32	9.65	4.32	15.25	13.32	5.92
1964	15.84	9.13	5.98	17.10	15.84	4.48
1965	18.83	9.05	3.24	17.56	18.83	4.36
1966	17.11	8.88	5.79	14.80	17.11	5.68
1967	17.26	5.72	4.29	13.52	17.26	6.10
1968	14.87	6.49	4.53	14.64	14.87	7.70
1969	16.39	8.07	5.15	13.21	16.39	7.87
1970	15.34	6.26	5.84	13.54	15.34	8.41
1971	17.06	6.26	4.41	13.13	17.06	10.45
1972	12.44	7.13	3.96	12.27	12.44	5.73
1973	12.12	7.50	4.04	9.32	12.12	2.17
1974	12.43	7.57	3.36	8.08	12.43	3.33
1975	10.80	8.05	3.48	8.56	10.80	5.22
1976	7.79	12.19	5.29	6.67	7.79	5.06
1977	8.69	17.06	5.12	1.53	8.68	6.60
1978	7.96	14.27	4.21	0.46	7.96	6.67
1979	7.41	14.66	3.83	0.74	7.41	12.47
1980	10.77	10.78	3.13	0.67	10.77	12.13
1981	8.71	10.86	3.52	0.85	8.71	17.48
1982	9.70	10.59	5.86	0.98	9.70	15.15
1983	10.08	12.56	5.93	0.73	10.08	17.18
1984	8.27	12.55	4.94	1.00	8.27	15.56
1985	8.36	11.63	6.69	1.96	8.36	13.73
1986	7.42	13.89	8.74	2.78	7.42	11.36

Source: Statistical Abstracts (various (issues).

Note: * All African countries except Tanzania and Uganda

2.30 Attempts at Trade Liberalisation

Under the shadow of economic difficulties of the early 1970s a shift in trade and industrial policies began to emerge. This shift is apparent in the 1974/78 Plan; and in the introduction of export subsidies under the Local Manufactures (Export Compensation) Act of 1974.

The 1974-78 Plan called for an efficient industrial sector which could produce goods which were competitive both in quality and price in the world markets. This was to be achieved by the creation of a liberal trade regime through uniform tariff protection and relaxation of import controls. Tariffs and import controls were to be eventually replaced by excise and sales taxes. However, to avoid discouraging production for export these taxes were to be waived for the inputs to export oriented industries.

The Local Manufactures Act introduced the most clear policy on export promotion. The subsidies introduced under the Act were to replace duty drawbacks which had been deemed costly and unpredictable. The Export Compensation Scheme was therefore meant to reduce administrative costs and facilitate prompt payments to exporters. The Scheme allowed exporters of eligible goods to claim 10 percent of the f.o.b. value of the goods declared for export or 10 percent of export earnings received in foreign currency, whichever was less. A further rule for eligibility was that the exported goods be wholly produced in Kenya; and where imported inputs were used in production, their value would be less than 70 per cent of ex-factory price of the goods.

The poor economic conditions in 1974 and 1975 and later in 1978 and 1979 however made the trade liberalisation policies difficult to implement. But because of the economic crisis of the late 1970s and the fear of a protracted economic slowdown the government had to seek external funds to finance development and balance-of-payments deficits. This led to aggreements on structural adjustment programmes between Kenya and the World Bank and several stand-by arrangements with the IMF.[8/] [9/] The loans obtained under these agreements were conditional on implementation of policies aimed at liberalising Kenya's economic system. Some of these policies have been articulated by the 1979-83 and 1984-88 Development Plans, the Sessional Paper No.4 of 1980 and 1982, various budget speeches, and the Sessional Paper No.1 of 1986.

Under the structural adjustment programmes, trade and industrial policies were to be actively used to restructure the economy; and particularly the manufacturing sector. This was seen as necessary to boost economic efficiency and increase competitiveness. The growth of the industrial sector was also to be enhanced through greater reliance on the private sector and foreign investments.

Several specific policies were to be used to achieve these objectives. These included reforms of tariff and import control systems and an array of export promotion measures.

Tariff "rationalisation" was to be initially carried out through reduction of duties on consumer goods and increases of those on intermediate and capital goods. Thereafter, all tariffs were to be gradually reduced. The use of quantitative restrictions as a means of protection was to be reduced. For example, more imports were to be placed on the OGL (the list with no restriction) and other less restrictive lists; and the "non-objection certificates" were to be abolished.

A variety of policies were to be used to promote exports. These included; review and modification of the export compensation scheme; maintenance of "realistic" exchange rates; introduction of manufacture under bond; establishment of an export credit insurance and guarantee scheme; encouragement of increased production of non-traditional exports; attempts to seek new markets in Africa, Middle East, USA, Japan and Eastern Europe; and increased government support for a liberal world trading system, including increased participation in regional and international cooperation.

The extent to which some of these policies have been implemented, together with their effectiveness, is discussed below. This is done selectively since a detailed analysis of all the policies is beyond the scope of this study.

2.31 Tariff Reforms

Under the 1980 liberalisation program a 10 percent tariff surcharge was imposed on all imports; tariff increases were also imposed on over 200 import items.[10/] The purpose of the tariff surcharge was to protect domestic industry from the effects of relaxation of import controls while tariff increases was a means of rationalisation. The reforms began in 1980 were continued in 1981 with tariff increases ranging from 2-90 percent imposed on about 1400 items. There were also tariff reductions on about 20 import items used mainly by export oriented industries.

The tariff increases of 1980 and 1981, as shown in Table 2.7, were followed by further increases at an average of 13 percent in 1982. In 1983 tariffs were reduced to about 1981 levels and the reductions continued in 1984. However, it is evident that the process of tariff reductions lost steam in subsequent years. With exception

TABLE 2.7

Unweighted Average Tariff Rates By SITC Category

	1981/82	1982/83	1983/84	1984/85	1986/87
Crude Rubber	37	40	37	32	29
Cork and Wood	47	52	47	39	42
Pulp and Waste Paper	54	60	51	42	36
Textile Fibres	39	42	38	37	37
Metal Ores	35	38	33	28	24
Chemicals	39	43	39	38	30
Medicines	20	22	20	17	16
Chemical Products	37	41	39	34	31
Leather	51	56	50	46	48
Rubber Manufacturers	46	64	55	54	54
Textiles	68	76	67	57	57
Non-Metallic Minerals	47	54	48	41	40
Iron and Steel	28	34	31	27	28
Non-Ferous Metals	42	46	41	32	31
Metals	49	55	49	42	42
Machinery	29	33	29	26	22
Clothing	100	111	102	89	89
Footwear	49	54	45	45	45
Total Average	45	51	46	40	39

Source: Import licensing schedules (various issues).

of a few commodities, there were hardly any tariff reductions between 1984 and 1986. It is also evident that during this period there was little movement towards uniform tariffs.

2.32 Import Controls

Under the 1980 liberalisation program import bans and requirements for "non-objection certificates" were removed. Import controls were to be relaxed from 1981 by shifting 20 percent of the items from Schedule IIA to Schedule I each year.[11/] This is reflected in the 1982 import schedule (Table 2.8) which had 11 percent more items in Schedule I than in 1981.

TABLE 2.8

Number of Licensed Items by Schedule Category

Schedule	1981/82	1982/83	1983/84	1984/85
I	1131 (42)[1]	1444 (53)	NA[2]	NA
IA	NA	NA	784 (29)	803 (30)
IB	NA	NA	673 (25)	961 (35)
IIA	687 (26)	398 (15)	NA	NA
IIB	867 (32)	868 (32)	869 (32)	903 (33)
IIAS	NA	NA	84 (3)	92 (3)
IIAO	NA	NA	314 (12)	NA
Total	2689	2710	2724	2759

Source: Import Licensing Schedules (various issues)

Note: 1: Numbers in brackets are percentage of total licensed items.
2: Not applicable.

Schedule I : Essential goods imported freely through automatic licensing and foreign exchange allocation.

IIA : Priority imports for use in industry and agriculture. Receive regular foreign exchange allocation but less than of I.

IIB : Luxury imports and goods produced domestically. Schedule used to protect domestic industry and for BOP purposes therefore receive residual foreign exchange.

IA : Same as I.

IB : Same as IIA.

IIAS : Goods imported only by authorised agents or requiring ministry approval before license is issued.

IIAO : Non-luxury imports subject to quota and receive only residual foreign exchange.

As shown by Table 2.8 the licensing system had to some extent been liberalised by 1985. More items had been moved to the more liberal Schedule I. However, the number of items on the more restrictive Schedule IIB and indeed the total number of licensed items has remained more or less the same over time.

2.33 Export Compensation

The contribution of export compensation to the promotion of exports has generally been considered to be minimal. Exporters have often claimed that the compensation rate was too low, and that payments were not made promptly. The liberalisation program of 1980 set out to deal with some of these claims. Under the program the basic rate of compensation which had remained at 10 percent since 1974 was raised to 20 percent. However, the scheme was suspended in June 1982 because it was viewed as ineffective in promoting exports. The government argued that claims were made by only four or five firms which were already competitive in world markets and therefore required no incentives. It was also argued that the domestic value added requirement was often not applied and hence non-qualifying exports obtained compensation.[12/]

When the scheme was re-introduced in December 1982, the basic rate had been reduced to 10 percent, but an additional rate of 15 percent was to be paid to exporters whose earnings increased over the previous year's earnings. But this new system created more problems than were first anticipated. For example, exporters regularly changed their names or lagged exports in order to qualify for the incremental payments; and in most cases the claims reflected increases in prices rather than the volume of exports. In 1985 the incremental rate was abolished and the basic rate was raised back to 20 percent.

Although the Export Compensation Scheme has been in force since 1974 its effectiveness has not been systematically analysed. Low (1982) could not establish any definitive relationship between the scheme and export performance. He found that while most eligible exporters did not claim the subsidy, those who did treated it as a windfall gain. The fact that export compensation has over the years amounted to no more than 0.2 percent of export earnings over the years suggests that it has had little significant role in export promotion. The problem with the constant changes in the compensation rate is that it would affect the credibility and hence effectiveness of the scheme.

2.34 Exchange Rate Regime

One of the major planks of the 1980 liberalisation programme was to introduce a flexible exchange rate regime which could serve as an instrument for protection and export promotion. Historically, the Kenyan Shilling had been pegged to the Sterling pound but between 1975 and 1980 the Kenya shilling was pegged to the SDR at a rate of 1 SDR to Ksh.9.70. This regime ended with the devaluations of February and September 1981 amounting to 23.7%. There was a further devaluation of the shilling by 17.7 percent in December 1982. This exchange rate was in force until May 1983 when the shilling was again devalued by 2.6 percent. After this devaluation the official exchange rate policy became one of "managed float" in which the shilling, then pegged to a basket of currencies, was allowed to fluctuate within certain margins. Overall, between 1980 and 1986 the shilling depreciated by 98% and 112% against the SDR and the dollar, respectively.

In analysing the impact of exchange rates on exports a more appropriate indicator is the real effective exchange rate (REER) index. This index is obtained using trade weighted average exchange rates deflated by the ratio of the domestic consumer price index and the trading partners' (Britain, Germany, Netherlands, Japan, France, Italy and USA) wholesale price index.[13/] Table 2.9 shows indices of nominal and real effective exchange rates. By construction, an increase in the nominal exchange rate index (NEER) implies a devaluation. Therefore, its increase from 1981 onwards reflects the devaluations of 1981-1983 and the policy of managed float started in 1983. It is also evident that REER was not overvalued in the 1960s and early 1970s, but began to be overvalued after 1972. The REER began to depreciate in 1978, partly due to a decline in terms of trade after the coffee boom, and thereafter because of devaluations and a flexible exchange rate policy. It is however clear that the depreciation of the real exchange rate has not been consistent since 1978. This would create uncertainty among the exporters and therefore negatively affect export performance.

2.40 Summary

In this Chapter the development of Kenya's trade policies since independence is reviewed. It has been shown that although wide ranging ISI policies began to be implemented after independence, the trade regime remained relatively liberal in the 1960s. However, protectionism and especially the role of quantitative restrictions began to escalate in the 1970s. An attempt is made to link these trade policy changes to the pattern of economic development. It is argued that the high economic growth of the first decade of independence was associated with the so-called "easy phase" of ISI policies. The slow down in subsequent years is attributed to several

TABLE 2.9

Nominal and Real Effective Exchange Rates
(1980 = 100)

	NERX	RERX
1960	86.98	93.91
1961	86.57	94.54
1962	86.00	91.86
1963	87.41	91.79
1964	85.26	96.10
1965	84.34	92.40
1966	85.72	92.79
1967	85.23	83.50
1968	83.14	85.39
1969	82.01	88.94
1970	83.37	94.17
1971	83.41	96.97
1972	86.96	99.53
1973	86.53	103.05
1974	84.47	107.98
1975	89.01	103.69
1976	91.83	108.01
1977	90.95	104.61
1978	94.17	95.36
1979	98.11	99.67
1980	100.00	100.00
1981	102.92	100.84
1982	115.05	99.31
1983	129.85	103.73
1984	124.41	95.18
1985	142.87	98.61
1986	174.32	112.53

NERX : Nominal effective exchange rates weighted by exports.
RERX : Real effective exchange rates weighted by exports.

factors, the dominant of which are the external shocks of 1970s and 1980s, and the poor economic conditions in the world markets. The bias of ISI policies against exports also played some role in the poor economic performance after the growth decade.

Although several studies in the early 1970s argued against the protectionist nature of Kenya's trade regime and called for liberalisation, the major impetus for trade liberalisation largely resulted from the economic difficulties of the period. For instance, while some stabilisation and liberalisation policies were implemented in an attempt to mitigate the negative effects associated with the first oil crisis it was not until after the structural adjustment agreements of 1980 that serious steps were taken towards trade liberalisation.

No attempt has been made in this Chapter to evaluate the macroeconomic effects of the liberalisation policies of the 1980s. Indeed, this will not be the purpose of this study. Our aim will be to simulate the effects of trade liberalisation using counterfactual experiments. While the data used will be those of the Kenyan economy, they will not correspond to those of the years associated with the liberalisation.

CHAPTER THREE

MODELING TRADE POLICIES IN LDCS

3.0 Introduction

The disequilibrium in LDC economies during the 1970s and 1980s has been dealt with by stabilisation and structural adjustment policies. Attempts to assess the effectiveness of these policies have stimulated increased modelling of LDC economies. Some of the studies have relied on computable general equilibrium (CGE) models. The use of CGE models can be justified on the grounds that, unlike partial equilibrium models, they explicitly model economy wide resource allocation and interaction among economic agents. CGE models also, by endogenising price and quantity changes, are more suited for modelling the mixed economies common in LDCs than the earlier fix-price input-output type models. For example, by affecting the agents incentives and/or expectations, price changes lead to income and substitution effects in demand and production. In this sense the behaviour of the agents in the economy is realistically accounted for in the model.

The earliest survey on the application of CGE models is Shoven and Whalley (1984). This work concentrated on the application of CGE models to international trade and taxation issues in both developed and developing countries. While the original applications of CGE models to developing countries, for example, Adelman and Robinson (1979) and Taylor et al. (1980), focused on the analysis of growth and income distribution; the more recent models have covered wider issues. Devarajan et al. (1986) and Decaluwe and Martens (1986) provide bibliographic surveys, including the most recent applications, of LDC CGE models. Dervis, de Melo and Robinson (1982) initiated a vast development and application of CGE models to LDC economies. The most recent surveys of these models are provided by Srinivasan and Whalley (1986), de Melo (1988) and Robinson (1989). The importance of trade to LDCs is evident from the fact that most of these models have been constructed to analyse trade and/or trade related issues. In recent years these issues have centred on the structural adjustment process; and especially the use of stabilisation and trade liberalisation policies to deal with economic disequilirium in LDCs.

The origins and consequences of economic difficulties which have afflicted LDCs in the past two decades are now well documented. The oil crises of the 1970s and the persistent debt crisis of the 1980s together with inappropriate domestic policies and the weak underlying economic structures in these countries have been the major contributors to the economic disequilibrium. The disequilibrium has mainly been in the form of serious balance of payments deficits, low and in many cases declining economic growth. As stated above stabilisation and liberalisation policies have been used to deal with these problems. Although these two types of policies are often simultaneously implemented, their targets, instruments and time horizons may differ.

Stabilisation policies are aimed at moving the economy back to equilibrium. This normally involves efforts to maintain a given desired level of employment, capacity utilisation and balance of payments equilibrium. The main instruments in such cases would be monetary and fiscal aggregates and exchange rates. On the other hand, liberalisation polices involve shifts in policy regimes. While such changes may have stabilising effects in the short-run, their effect is to shift the equilibrium in the medium to long-term. The main instruments used for liberalisation include tariffs, subsidies, exchange rates and changes in import controls. It should also be noted that policy effects can be negated by the existence of structural rigidities. This point underlies the elasticity pessimists' arguments about the ineffectiveness of trade policy changes in LDCs. The structural adjustment policies, by changing the institutional structures, are therefore aimed at breaking these rigidities.

The purpose of the implementation and the expected gains from trade policies highlight the usefulness of CGE models as tools for policy evaluation. This Chapter examines the specification of trade policy models for LDCs. An attempt is made to explain how the traditional trade models are modified to reflect realistic behaviour of LDC economies. It will also be shown that the modifications often generate their own biases. A small sample of the expanding literature on modeling trade policies in LDCs will also be reviewed, with emphasis placed on the few CGE models of the Kenyan economy. These reviews serve as a contrasting background to the model used in this study.

3.1 Models of Trade Policy in LDCs

The conventional pure trade theory models are firmly based on the theory of comparative advantage; with trade determined by relative factor intensity and endowments among nations. These models are mostly qualitative and have almost exclusively been confined to the two-factor two-commodity cases. It is now well understood that to move from these types of models to the multisectoral CGE type models poses some problems. Samuelson (1953) has shown that free trade implies specialisation so that where there are more goods than factors a trade policy change will cause some industries to shut down until the number of goods produced equal the number of factors. Furthermore, under the small country assumption foreign prices and hence external terms of trade are given. This implies perfect substitutability between domestic and imported goods. In this case, foreign prices determine the domestic price of tradables; the so called "law of one price". However, the assumption underlying the traditional model are often contradicted by real world observations and/or make empirical application of the model impractical. For example, although "the law of one price" implies absence of cross-hauling this phenomenon has been observed as a feature of trade between countries. Grubel and Lloyd (1975) found two-way trade, even for commodities with high SITC level, to be high. Moreover Isard (1978) and Dornbusch (1987) have shown that the "law of one price" does not always apply even for highly homogenous commodities.

At the empirical level, working with multisectoral models means that there are always going to be more products than factors. A change in trade policy would therefore lead to complete specialisation. Some studies have tried to avoid this problem by specifying highly aggregated sectors in order to match the number of primary factors with the sectors in the economy. This is especially true of the dependent economy models with two or three sectors classified as traded and non-traded. The problem with such models is that they fail to capture the true dynamics of sectorial resource allocation in the economy. Another alternative method is to assume decreasing returns to scale by introducing sector-specific factors such as capital and land. This introduces an upward sloping supply curve. The most commonly used alternative in recent years, following Armington (1969), has been to assume that domestic and foreign goods are imperfect substitutes. This assumption also accommodates the existence of cross-hauling. Its major advantage however is that import and domestic prices need not be equal and therefore the problem of specialisation as a result of trade policy change will not arise. Furthermore, this assumption allows for higher disaggregation of sectors; a common feature in multisectoral modelling.

The Armington assumption defines total domestic supply of each good as a composite commodity (X_i) which is a CES function of domestic (D_i) and imported (M_i) commodities. This aggregation is given by:

$$X_i = \beta_i [\gamma_i M_i^{-\rho_i} + (1 - \gamma_i) D_i^{-\rho_i}]^{-1/\rho_i} \tag{3.1}$$

where β_i , γ_i are constants and ρ_i is a parameter that defines the elasticity of substitution of domestic and imported goods as $\sigma_i = \frac{1}{1 + \rho_i}$ The demand for domestic and imported goods are obtained as derived demands by minimising the cost of obtaining the composite commodity (X_i)

$$P_i X_i = PD_i D_i + PM_i M_i \tag{3.2}$$

subject to (3.1) to get (assuming no technical change) the shares of each commodity in total supply as

$$\frac{M_i}{X_i} = \gamma_i^{\sigma_i} \left(\frac{P_i}{PM_i}\right)^{\sigma_i} \tag{3.3}$$

and

$$\frac{D_i}{X_i} = (1 - \gamma_i)^{\sigma_i} \left(\frac{P_i}{PD_i}\right)^{\sigma_i} \tag{3.4}$$

From (3.3) and (3.4) import shares are obtained as:

$$\frac{M_i}{D_i} = \frac{\gamma_i}{1 - \gamma_i}^{\sigma_i} \left(\frac{PD_i}{PM_i}\right)^{\sigma_i} \tag{3.5}$$

where PD_i and PM_i are the prices of domestic and imported goods, respectively; and the composite price, P_i , is a CES aggregation of PD_i and PM_i ; that is

$$P_i = \frac{1}{\beta_i}[\gamma_i^{\sigma_i} PM_i^{1-\sigma_i} + (1 - \gamma_i)^{\sigma_i} PD_i^{1-\sigma_i}]^{\left(\frac{1}{1 - \sigma_i}\right)} \tag{3.6}$$

It is clear from (3.5) that import shares depend only on relative prices and σ_i . In the classical trade theory models, σ_i is assumed to be infinite, so that $PD_i = PM_i$, and the two goods are perfect substitutes. To the contrary, by allowing a wider range of σ_i , the Armington assumption implies that PD_i and PM_i need not be equal. For example, a high σ_i implies a high similarity between domestic and imported goods. The share of each commodity in total use will therefore be very price responsive. On the other hand, low σ_i indicates lower substitutability between the two goods. Where the share of the two goods are relatively stable because of low σ_i the two goods become complements. Notice that the behaviour of P_i as represented by (3.6) ultimately depends on how its components are determined. The domestic prices PD_i are endogenously determined; while PM_i are exogenously given as:

$$PM_i = \overline{WP}_i(1 + \tau_{im})\ ER \tag{3.7}$$

where $\overline{WP}_i$ is a fixed world price, τ_{im} is the tariff rate in sector i, and ER is the exchange rate. The assumption behind this specification is that import supply is perfectly elastic at given prices. It is clear from (3.7) that trade policy changes affect composite prices and hence the structure of production. With fixed world prices, changes in the exchange rate (in a fixed exchange rate regime) and tariffs and hence PM_i will lead to changes in P_i.

To show how PD_i are formed, we first note that gross output prices, denoted by PX_i , are given by

$$PX_i = PN_i + \sum_j a_{ji} P_i \tag{3.8}$$

where PN_i are value added or net prices and a_{ji} are input-output coefficients. Defining commodity tax rates on domestic goods as τ_{id}, the prices of domestic goods will be given by

$$PD_i = PX_i (1 + \tau_{id}) \tag{3.9}$$

From (3.8) the endogenous changes in PD_i can be traced to the changes in prices of primary factors (PN_i) and intermediate inputs (P_i) .

Note that with the payment of taxes in (3.7) and (3.9) PM_i and PD_i and hence P_i are valued at market prices. It is through the agents response to P_i that trade policy affects the economy. In particular, it not only affects the structure of production and hence resource allocation, but also the level of consumption.

Exports can be modelled in a symmetrical way as imports. In traditional models export supply is treated as a residual after the domestic market has been satisfied. This assumes that supplies to both markets are perfect substitutes and that relative prices determine supply to each market. For example, an increase in the domestic price of a commodity will reduce domestic demand and therefore increase export supply. The problem with this approach, as pointed out by Dervis et al (1982), is that if in fact gross outputs supplied to the domestic market are different from those exported then the responsiveness of export supply to price changes may be overestimated. This problem is dealt with by assuming imperfect substitutability between gross outputs sold in the domestic market and those exported.

Differentiation between exports and domestically consumed goods can arise from aggregation problems or because of differences in quality. In our data, for example, agricultural goods are made up of food crops and cash crops, mainly tea and coffee. Cash crops are mostly exported while food crops are consumed in the domestic market. Since cash crops form a small portion of agricultural output, the price responsiveness of exports will be overestimated under the assumption of perfect substitutability. Morever, even for homogenous goods like coffee and tea what is exported and consumed domestically may differ in quality.

To model exports in a symmetrical way with imports it is assumed that producers transform gross output into goods to be supplied to domestic and export markets. This is done using a constant elasticity of transformation (CET) function introduced by Powell and Gruen (1968). The aggregation of the two types of goods can be specified as

$$X_i = \beta_i [\alpha_i XE_i^{\theta_i} + (1 - \alpha_i) XD_i^{\theta_i}]^{\frac{1}{\theta_i}} \tag{3.10}$$

where X_i is the gross output, XE_i and XD_i are output for export and domestic market respectively; β_i and α_i are constants, and θ_i is a parameter that determines CET as $\psi_i = 1/(\theta_i - 1)$. Producers maximise revenue,

$$P_iX_i = PE_iXE_i + PD_iXD_i \tag{3.11}$$

subject to (3.10); where P_i , PE_i and PD_i are average sales prices, domestic currency price of exports, and domestic prices, respectively. Notice that the average sales price, P_i , is a CES aggregation of PE_i and PD_i in the form similar to the specification of (3.6).

From the first order optimality conditions of the producer's optimization problem, the allocation of gross output between domestic sales and exports is specified as:

$$\frac{XE_i}{XD_i} = \left(\frac{\alpha_i}{1 - \alpha_i}\right)^{\psi_i} \left(\frac{PE_i}{PD_i}\right)^{\psi_i} \tag{3.12}$$

The elasticity of transformation (ψ_i) measures the degree of homogeneity between exports and domestic products and hence relative price response. For example, higher ψ_i implies higher honogeneity of the two products and therefore greater price response. With infinite ψ_i the two types of goods become perfect substitutes and we are back to the classical case where $PE_i = PD_i$. On the other hand, $\psi_i = 0$ implies that the two goods will be allocated to the two markets in fixed proportions. It is clear however that the use of CET drives a wedge between domestic and export prices. In particular,

PE_i is defined as:

$$PE_i = \frac{PWE_i * ER}{1 + \tau_{ie}} \tag{3.13}$$

where PWE_i is the foreign currency price of exports, and τ_{ie} is the export tax or subsidy. When ER and τ_{ie} are treated as policy parameters, it is easy to see how changes in PE_i affects export shares in (3.12). For example, devaluation or export subsidy increases PE_i and therefore the share of exports in gross outputs.

The use of Armington and CET functions in the modelling of trade policies in LDCs has been motivated by the unrealistic high price responsiveness underlying the classical trade models. Although these functions introduce some realism, Grais et al (1984), Winters (1984) and de Melo and Robinson (1985) argue that they also introduce biases against price responsiveness. By driving a wedge between domestic and world prices these assumptions imply lower price response to policy change and therefore underestimate the cost of protection. This point should therefore be taken into account when analysing the welfare gains from trade liberalisation.

To examine the effect of trade policy changes on domestic prices we use a model by de Melo and Robinson (1985). This analysis will be limited to the effects of tariffs and export subsidies. Our major concern is to determine how and under what conditions domestic prices respond to these two policy instruments.

The change in domestic price due to change in domestic currency price of imports and exports are, respectively, derived (de Melo and Robinson, p.104) as:

$$PD_m = \frac{(\sigma - \varepsilon^q)\ \theta^m}{(1 - \theta^e)\ \varepsilon^s + \theta^e\psi + \varepsilon^q + (\sigma - \varepsilon^q)\ \theta^m} \tag{3.14}$$

and

$$PD_e = \frac{(\psi - \varepsilon^s)\ \theta^e}{(1 - \theta^e)\ \varepsilon^s + \theta^e\psi + \varepsilon^s + (\sigma - \varepsilon^q)\ \theta^m} \tag{3.15}$$

where θ^m and θ^e are import shares in total consumption and export shares in domestic production, respectively; ε^s is output supply elasticity and ε^q is the price elasticity of demand for composite goods.

From (3.14) and (3.15), it is clear that the effect of trade policy changes on domestic prices depend, other things being equal, on σ and ψ. Increase in tariffs will in general lead to increased demand for domestic goods; therefore the easier it is to substitute domestic goods for imports the higher will be the domestic price. Similarly, higher export subsidies will increase demand for exports and hence the easier it is to transform domestic goods into exports the larger will be the domestic price change. Higher trade shares, θ^m and θ^e, also imply higher domestic price response to policy change. On the other hand, high ε^{s} and ε^{q} reduces the price response. In particular, a high ε^{s} means that a policy which shifts resources in favour of domestic production will lower the domestic price response; while higher ε^{q} (given that σ is always greater than ε^{q}) reduces the demand for composite goods and hence lowers the price response.

The devaluation of domestic currency is a widely used and controversial policy instrument in LDCs. Traditionally, devaluation has been prescribed as a means of correcting short-term external and internal imbalances. However, there has been an extensive debate about the effectiveness of this policy in LDCs. This debate has become intensive in recent years as devaluation has become a major policy recommendation in the World Bank-IMF type economic liberalisation programmes.

In the traditional dependent economy models the effectiveness of nominal devaluation rests on its expenditure switching effects. According to these models devaluation increases the price of tradables relative to non-tradables. By increasing the price of tradables, devaluation reduces the domestic demand; it also increases (reduces) the domestic (foreign) currency price of exports and hence supply (demand) of exports. In other words, higher domestic prices, by reducing domestic consumption increase goods available for exports (where exports are treated as residuals after domestic consumption) not only at lower prices to the foreign consumers but also at higher prices for the domestic producers in appropriately denominated currencies. Even where increased export supply is not forthcoming and as long as the usual Marshall-Lerner conditions are met, devaluation would still lead to higher export earnings. On the other hand, devaluation increases the demand for non-tradables and import substitutes. This increases the prices of these goods and therefore leads to a decline in their production. This results in resources being released for use in the production of export. Devaluation also by increasing import prices in domestic currency reduces import demand which together with higher export earnings, improves the balance of payments.

The apparent effectiveness of devaluation underlines its importance as a favourite policy recommendation by the IMF. However, while the effectiveness of devaluation in improving the balance of trade is widely agreed on, studies as far back as Hirschman (1949), Diaz Alejandro (1965) and Cooper (1971) have discussed the possibility of contractionary and adverse income redistributive effects of devaluation. The most recent studies to expound these issues are Krugman and Taylor (1978) and Taylor (1979 and 1983). The conclusions of these models depend on the possibility that the income effects, due to devaluation, may be strong enough to offset the expenditure-switching effect. For example, devaluation which leads to a high price level might reduce real incomes. This would result in a lower aggregate demand and hence a lower output. This result could be reinforced if devaluation redistributes income away from groups in the society with lower propensity to save to those with higher marginal propensity to save.

The stagflationary effect of devaluation comes out clearly in the Taylor model. This model assumes different savings rates between wage earners and capitalists and fixed nominal wages. It also assumes non-competitive imports of intermediate inputs, hence devaluation will tend to have low impact in the reduction of imports; but generates a greater inflationary effect. With fixed nominal wages, a rise in the price level implies lower real wages and hence income redistribution in favour of the capitalists who are assumed to be the higher savers. The other redistributive effect of devaluation is what Krugman and Taylor (1979) call the fiscal effects. Assuming that the government is a high saver, the existence of ad valorem trade taxes, means that a devaluation which redistributes income in favour of the government reduces aggregate demand. This assumes that government consumption or income transfers to lower savers does not increase with the tax receipts. This assumption is in line with the Taylorian model which fixes government consumption in real terms. Devaluation may also lead to higher fiscal deficits. Taylor (1979 : 57) argues that if an attempt is made to reduce the deficits either by tax increases or expenditure reductions, as is often recommended under structural adjustment programmes, it will exacerbate economic decline by further reduction in aggregate demand.

Apart from Krugman and Taylor (1978) and Taylor (1979, 1983) several other empirical studies have arrived at results supporting the contractionary effect of devaluation. Using small simulation models, Gylfason and Risager (1984) and Gylfason and Radetzki (1985) arrived at such results. Using an econometric model, Edwards (1986) concludes that devaluation leads to a small contractionary effect in the first year. The decline in output is, however, reversed in the second year, while devaluation is found to be neutral in the long-run. Branson

(1986) using a small simulation model for Kenya obtained results supporting the contractionary nature of devaluation.

3.2 Simple Model of Trade Liberalisation

In large multisectoral CGE models it is normally difficult to keep track of the exact channels through which key parameters respond to policy changes. It is therefore sometimes necessary to set up tractable prototype models for elucidatory purposes. Below we set up such a model using diagrammatic techniques now common in trade models. This simple two-commodity two-factor model will only be used to examine the policy effects on factor prices, factor allocation, and the implied changes in sectoral output. It should be added however that for empirical purposes the tractability of this type of model cannot substitute for the realism of multisectoral models.

The sector-specific model, popularly known as the Ricardo-Viner model, can be represented using a diagram introduced by Jones (1971) and Mussa (1974). This diagrammatic technique is often used in conjunction with the Edgeworth-Bowley (E-B) diagram introduced into international trade by Stopler and Samuelson (1941). A combination of these diagrams has been used by Neary (1978, 1981) and Edwards (1986) to analyse trade policy issues.

Figure 3.1 represents a two-sector, three-factor model. The two sectors, manufacturing and agriculture, employ mobile labour and sector-specific capital. We assume that manufacturing is capital-intensive while agriculture is labour-intensive. We also assume, for expositional purposes, that the prices of the two goods are exogenously determined in world markets. This rules out the terms of trade effects.

The top panel of the figure is a sector-specific diagram proper. On the horizontal axis, Q_MQ_A , is the total labour employed by the two sectors. The use of labour by the manufacturing sector is measured to the right from Q_M , while employment in agriculture is measured to the left of Q_A. The panel also encompasses the value of marginal products of labour employed in the two sectors VML_M and VML_A and hence their wage rates W_M and W_A on the vertical axes. The marginal product curves are downward sloping reflecting diminishing returns to labour due to the existence of sector specific capital. In the absence of factor market distortions the intersection of VML_M and VML_A at A determine the wage rate in the two sectors as W^0 . This implies full employment with Q_ME and Q_AE quantities of labour employed by the manufacturing and agricultural sectors, respectively.

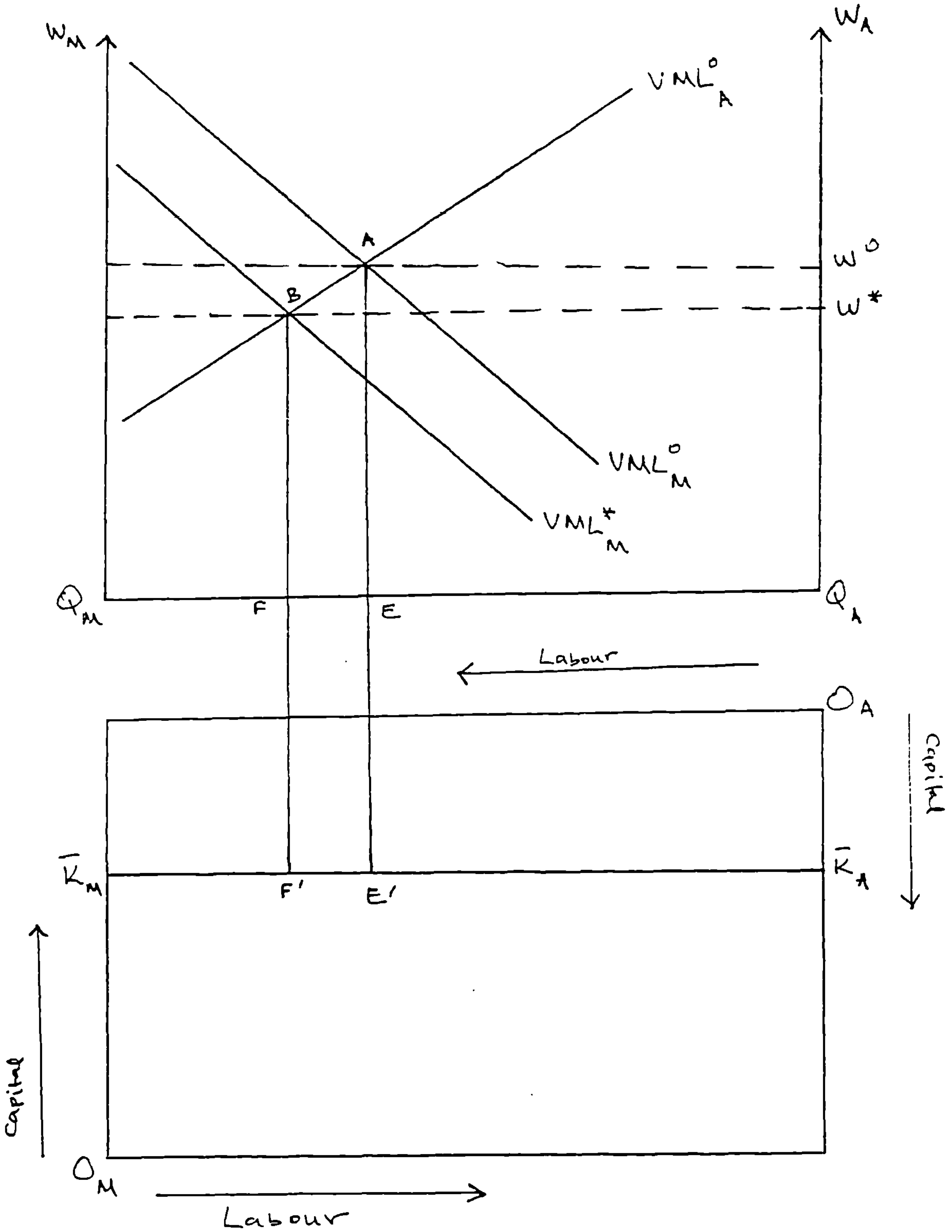
The lower panel of the figure is a traditional E-B diagram showing the combinations of capital and labour employed by each sector. Notice that as usual, the origin of the manufacturing sector is O_M and that of the agricultural sector is O_A. With the fixity of capital indicated by $\bar{K}_M\bar{K}_A$; $O_M\bar{K}_M$ and $O_A\bar{K}_A$ represent the fixed amounts of capital used in the manufacturing and agricultural sectors, respectively. The fact that all the equilibrium positions mapped onto the E-B diagram from the top panel lie above the diagonal (not drawn) of the diagram confirms that the agricultural sector is labour-intensive, while the manufacturing sector is capital-intensive. In general, factor intensities of course depend on the initial commodity prices and capital allocation.

To derive comparative static results the price of agriculture goods is firstly set as the numeraire. This means that the vertical position of VML_M is dependent on commodity prices while that of VML_A is not. Suppose domestic production of manufactures are import substitutes and that imports of this commodity are final consumer goods. Then a tariff-reduction will reduce the domestic price of the commodity. This will shift the marginal-productivity curve by the same proportion as the price reduction to VML^*_M, where B is the new equilibrium. At B the labour market clears at the lower wage (W^*). Note that since the decline in the price of manufactures is higher than that of the wage, the real wage in the sector rises. However, the real wage in the agriculture sector declines.[1/] These two results account for the decline in employment from Q_ME to Q_MF and the increase from Q_AE to Q_AF in the manufacturing and agricultural sectors, respectively. The labour released by the manufacturing sector is fully absorbed by the agricultural sector.

The changes in employment levels also lead to changes in capital-labour ratios and therefore returns to capital. For instance, the increase in employment in the agricultural sector increases the sector's capital-labour ratio and hence returns to capital. On the other hand, returns to capital in the manufacturing sector will fall with lower employment. The increase in employment in the agricultural sector will also lead to higher output, while manufacturing output will decline for the opposite reason. It should be emphasised that

FIGURE 3.1

Short-Run Effects of Tariff Reductions on Imports of Final Goods



all these results are peculiar to sector-specific models.

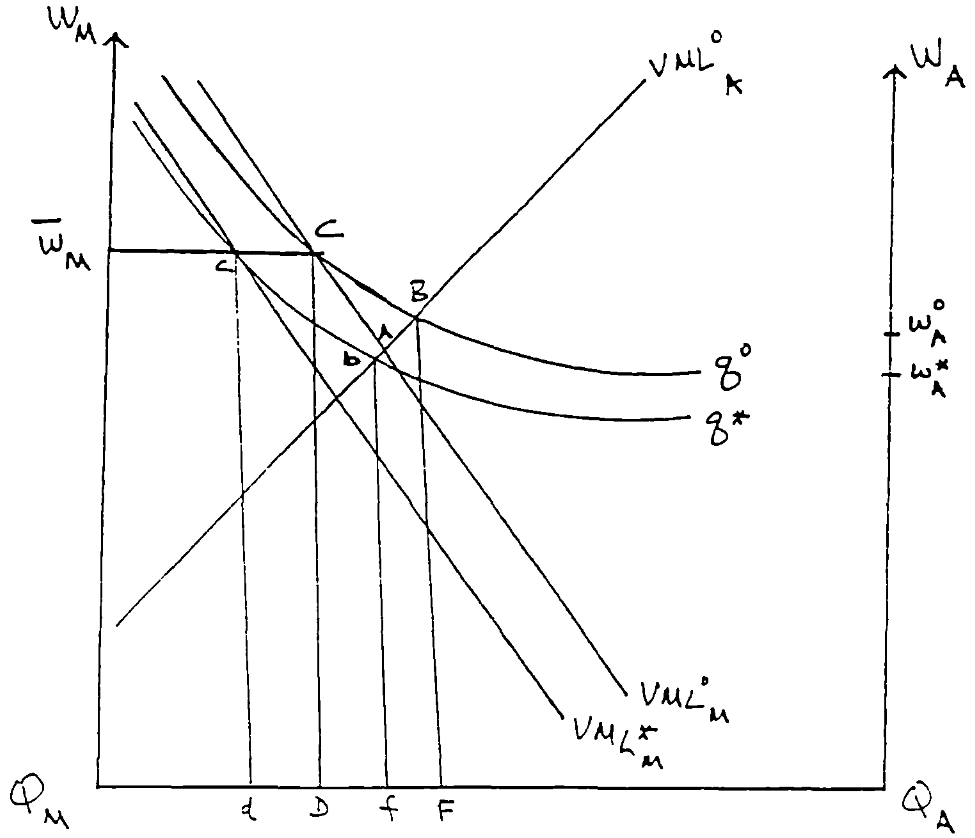
The assumption of flexible wages is unrealistic in LDCs where wages are institutionally fixed through minimum wage laws or wage indexation. To analyse the effect of wage rigidities in our two sector model we assume that the wage in the manufacturing sector is fixed in terms of agricultural goods.

With a fixed $\bar{W}_M$ the intersection of the marginal product curves does not determine the equilibrium wage anymore. This is evident from Figure 3.2. The agricultural wage (W_A) is now determined by the intersection of VML_A and the rectangular hyperbola qq known as the Harris-Todaro (H-T) curve introduced by Corden and Findley (1975). The set of wages $(\bar{W}_M , W_A)$ determine the employment levels Q_MD and Q_AF in the manufacturing and agricultural sectors, respectively. Notice that because the nominal wage in the agricultural sector is flexible, labour is fully employed; whereas wage rigidity leaves DF as unemployed labour in the manufacturing sector.

The effect of tariff reduction on imports as before, is to reduce the price of manufactures. This shifts the marginal product curve to VML^*_M and the H-T locus shifts to q*q*; implying a reduction in demand for labour in the manufacturing sector to Q_Md and an increase in agricultural employment from Q_AF to Q_Af. With the employment levels of the two sectors determined, unemployment in the manufacturing sector is shown as df. However, the change in total unemployment cannot be

FIGURE 3.2

Short-Run Effects of Tariff Reductions on Imports on Final Goods with Nominal Wage Rigidity in the Manufacturing Sector



determined from this diagram; for example, by comparing the relative sizes of DF and df .

As before, the pattern of resource (labour) allocation can be used to determine changes in output and returns to capital in each sector. For instance, increase in agricultural employment increases agricultural output while lower employment in the manufacturing sector will lead to lower output. The increase in labour employment in the agricultural sector will increase returns to capital in this sector and profits of the manufacturing capital will decline because of increased capital-labour ratio due to lower employment. Since the nominal wage is fixed in the manufacturing sector, a lower output price implies an increase in real wage. But the real wage in the agricultural sector (with constant output price) declines.

The clarity of the above results explains the attractiveness of the Ricardo-Viner model. The problem with the above analysis, which is typical of the use of the model in the literature, is that it assumes that the imports are only in the form of final goods. This assumption also explains why a tariff reduction will lead to a decline in output in the sector. If imports include intermediate inputs then the model results will be ambiguous. Under such circumstances the most natural way of looking at the sectoral effects of trade policy is through the theory of effective protection.

In a nutshell, effective protection is about the protection of an activity's value added. To see this clearly we define net price by rearranging (3.8) as:

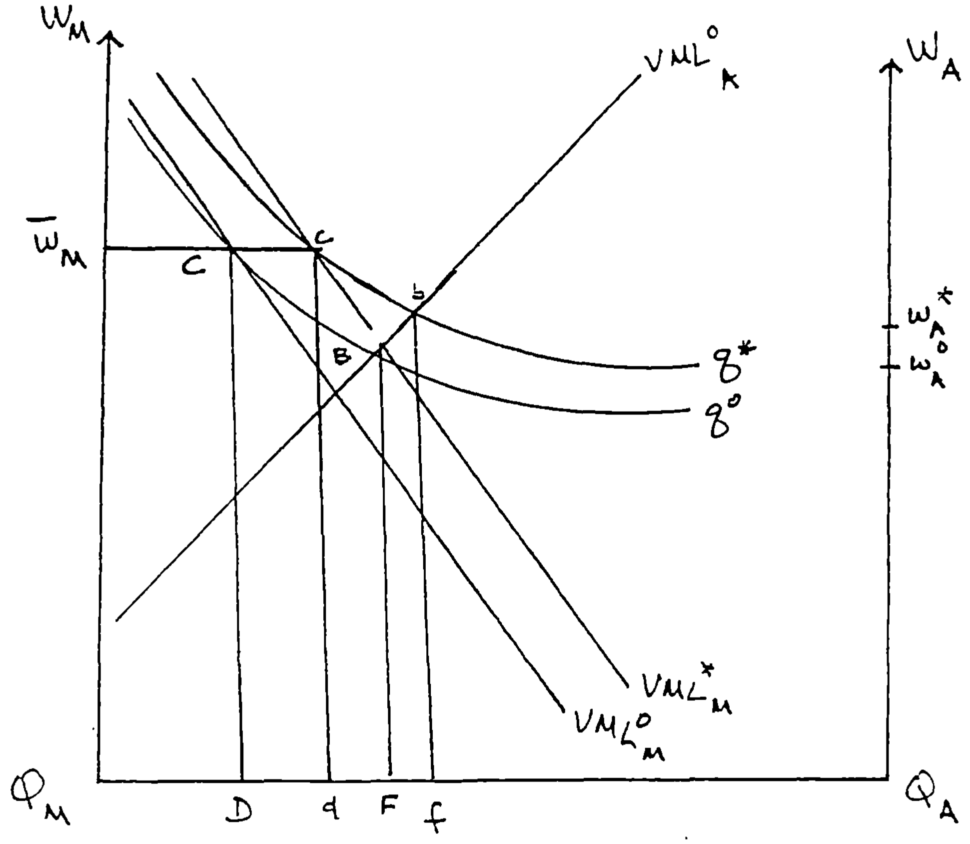
$$PN_i = PX_i - \sum_j a_{ji} P_j \tag{3.16}$$

Increase in PN_i in (3.16), by raising profitability, implies increased protection. This will stimulate increased activity levels in the sector. It is also clear from (3.16) that a sector can be protected by imposing tariffs on the goods it produces thereby increase PX_i and/or by providing subsidies for the intermediate inputs it uses, that is, lower P_j.

The effects of tariff reductions, assuming imports are only intermediate inputs, are shown in Figure 3.3. The policy change lowers the price of intermediate inputs in the manufacturing sector. This shifts the marginal product curve to VML^*_M, and hence the H-T curve to q^*q^* resulting in the new equilibrium points c and b . At these points, a lower real wage increases employment in the manufacturing sector from Q_mD to Q_md ; while a higher real agricultural wage (W^*_A) reduces employment in the sector from Q_AF to Q_Af . These shifts in labour allocation affect the sectoral capital-labour ratios and hence returns to capital. Returns to capital in the manufacturing sector will go up while returns to agricultural capital will decline. The increases in manufacturing employment will also lead to increased output in this sector while the opposite will happen in the agricultural sector. As before, the level of unemployment in the manufacturing sector cannot be determined from the diagram.

FIGURE 3.3

Short-Run Effects of Tariff Reductions on Imports of Intermediate Inputs with Nominal Wage Rigidity in the Manufacturing Sector



The two policy changes examined above are extremes in that they assume that imports are either for final consumption or intermediate use. In practice, imports are not only used for final and intermediate consumption, but also for capital formation. Tariff changes will therefore affect both PX_i and P_j in (3.16). The effect of policy change will in such event depend on the elasticities of substitution and the share of imports in each end use. The result is that the qualitative analysis of the policy effects on factor incomes, factor allocation and output will be ambiguous.

Another point to be made about the above results is that so far the model only explains the direction, but not the magnitude of the changes in factor incomes. The policy effects on the actual amount of factor incomes depend on factor substitutability and intensities in each sector. Jones (1971) and Mussa (1974) discuss these relationships. In particular, Mussa shows that the higher the elasticity of substitution between capital and labour the higher the wage response to changes in the output price of the sector in which the factor is intensively employed. A similar result obtains the lower the share of labour in the value of the sector's output. On the other hand, capital incomes are determined in each sector as a residual after payments to labour.

The predictions of the three-factor, two-sector model can be extended to include many sectors each using a sector specific factor and one mobile factor. However, once more than one mobile factor is introduced, the model's results become less clear-cut. In such circumstances empirical results have to be relied upon to ascertain the effects of trade policy change.

3.3 Literature Review

In this Section we provide a brief review of the literature on LDC CGE models. Table 3.1 provides a list and summary of the features of the models reviewed. What is surprising is that although there is now a sizeable number of LDC CGE models, many of which incorporate a foreign trade sector as an important component, very few are on sub-Saharan Africa economies. One would expect that since these economies have suffered the most from external shocks more effort would have gone into modeling them. Furthermore, most of these countries have undertaken or are implementing structural programs. The use of CGE models would provide realistic assessment about the impact of such programs.

The selection of the literature reviewed concentrates only on modelling trade policy issues. This small sample has been chosen just to highlight the features and implication of models of trade liberalisation. Of the models reviewed five relate to the Kenyan economy. The differences in purpose and dimensionality among these models preclude detailed comparison.

Clarete and Roumasett (1987) simulates the effects of 100 percent tariff and export subsidy reductions on the Philippine economy. The model is highly neoclassical with production and consumption functions specified as Cobb-Douglas and prices are assumed to clear all factor and product markets. The specified seven sectors are

TABLE 3.1

Summary of the Characteristics of LDC Trade Models

	Model	Country	Base Year	Dimension
1.	Clarete and Roumasset (1984)	Philippines	1975	7 sectors, mobile labour and sector-specific capital one representative consumer
2.	de Melo and Robinson (1982)	Columbia	1970	8 sectors; 3 types of labour: agricultural labour and mobile skilled and un-skilled labour; 3 types of capital; six consumer groups
3.	Devarajan and Offerdal (1989)	Cameroon	1979/1980	11 sectors; 3 types of labour: rural labour, urban skilled and unskilled labour; mobile or sector-specific capital; representative consumer
4.	Grais, de Melo and Urata (1986)	Turkey	1978	8 sectors; one mobile labour category; mobile or sector-specific capital; representative consumer
5.	Levy (1987)	Mexico	1975	10 sectors; sector-specific capital and labour; 2 consumers
6.	Blomqvist and McMahon (1984)	Kenya	1978	2 sectors; one mobile labour category; mobile or sector-specific capital; 2 consumers
7.	Gupta and Togan (1984)	Kenya	Not Specified	4 sectors; 3 factors: land, mobile labour and capital; 3 consumer groups
8.	Bevan, Collier and Gunning (1987)	Kenya	1975	36 commodities; 46 rural and 8 urban households; mobile labour and sector-specific capital
9.	McMahon (1986,1987)	Kenya	1964	4 sectors; 3 factors: mobile labour, sector-specific land and sector capital; 4 consumers
10.	Roe and Pal (1986)	Kenya	1976	6 sectors; 4 factors: skilled and unskilled labour, land specific to agriculture, sector-specific capital; 4 households

Model	Production	Final Demand	Foreign Trade	Closure
1.	CD aggregation of labour and capital; IO aggregation of intermediates	Cobb-Douglas (CD) consumption functions	Classical small country assumption (SCA)	Savings driven
2.	CD aggregation of labour and capital; IO aggregation of intermediates	LES consumption functions	Product differentiation for both exports and imports	Investment driven
3.	CD aggregation of labour and capital; IO aggregation of intermediates	Cobb-Douglas consumption functions	Product differentiation for both exports and imports	Fixed nominal exchange rate
4.	CES aggregation of value added; IO aggregation of intermediates, but CES aggregation of domestic and imported intermediates	LES functions for households; fixed real government consumption; fixed real investment by sector of origin	Product differentiation for both exports and imports	Savings driven
5.	Mark-up pricing intermediates	LES functions for households; fixed real government consumption	SCA for imports; export demand function specified	Fixed nominal exchange rate
6.	CES aggregation of capital and labour	LES functions	SCA	Savings driven
7.	Nested CRESH for primary factors; IO aggregation of intermediates, but CES aggregation of domestic and imported intermediates	LES functions	Armington assumption; export demand function specified	Savings driven

Model	Production	Final Demand	Foreign Trade	Closure
8.	CES aggregation of primary factors	Household consumption not given; fixed government consumption and investment demand	SCA	Savings driven
9.	CES aggregation of primary factors	LES functions; investment is a composite of domestic and imported goods	Armington assumption for secondary and tertiary goods; export demand functions specified for secondary and tertiary goods, all coffee is exported, and exports of agricultural goods are residual	Investments driven
10.	CES aggregation for primary factors; IO aggregation for intermediates, but CES aggregation for domestic and imported intermediates	LES functions; fixed investment and government demand	Armington assumption; export demand functions specified for all sectors except services and infrastructure which are treated as residual	Savings driven

further classified as: exportables (commercial crops, agricultural foods, and industrial goods); importables (industrial importables and import substitutes); and home goods (other agriculture, and services). The small country assumption prevails, that is, foreign and domestic goods are assumed to be perfect substitutes, so that domestic and foreign prices are directly linked. To avoid complete specialisation that would arise from such a specification the assumption of sector specificity of capital is used.

The single household earn wage income and profits and receives lump-sum transfer incomes from the government. The government does not consume, while the household consumes all its income. Savings and investments are not explicitly specified. Given the importance of savings and investments in economic growth process and ultimately in resource allocation this omission is highly unwarranted.

The model specifies the real exchange rate as the relative price of traded and non-traded goods. The adjustment of this relative price clears the trade balance. Because of the classical nature of the model the trade balance is obtained as the excess demand of the composite traded good.

The simulation of the model involves total tariff reductions from the base values of 23% and 62% on industrial importables and import substitutes, respectively; and 5% subsidy rate on commercial crops and 3% subsidy on both agricultural foods and industrial exportables. The conventional nature of the model allows for easy interpretation of its results. It is estimated that the welfare loss associated with tariffs and export taxes is equivalent to 3.4% of free trade income. Trade liberalisation would therefore be welfare improving. The model also establishes that resource allocation effects of the policy change would be in favour of importables and home goods at the expense of exportables.

Clarete and Roumasset argue that their model is a static Shoven-Whalley type model that can "be used for analysing tariff policies in small developing countries" (p.258). However, their estimated welfare gain from trade liberalisation of 3.4% is much higher than that normally associated with Shoven-Whalley models; which is usually around 1%. This overestimated result arises from the assumption of perfect substitutability between domestic and foreign goods, and also the sector-specificity of capital. Beside the unrealistic assumption of product homogeneity, the specification of Cobb-Douglas production functions implies high labour-capital substitution which is difficult to justify for LDCs. The specification of CD utility functions also implies the usual unrealistic unitary income elasticity. We therefore conclude that far from being useful for modelling LDC trade policy reform, the Clarete Roumasset model is more suited for illustrative purposes.

The de Melo and Robinson (1982) model analyses the effects of trade policy on income distribution. This is reflected in the high disaggregation of consumers and factors. The model has three types of labour; an aggregate landless labour specific to the agricultural sector, and mobile skilled and unskilled labour. Capital is aggregated into three types: agricultural, manufacturing and services. The six consumer groups correspond to the six factors so that the role of the policy change on functional distribution of income becomes crucial.

Like the previous model, primary factors combine in Cobb-Douglas form and intermediate inputs combine in Leontieff coefficients in this model. Consumer demands are however specified as LES functions. This avoids the restrictive unitary income elasticity associated with CD functions.

To concentrate on the effects of trade policy de Melo and Robinson impose several restrictions on the model. Firstly, government consumption is fixed in real terms. This "neutralises" the impact of the government on the economy. This is achieved through proportional income transfers between the government and the households. For example, when government budget is in surplus, income transfers to households must be positive. Secondly, private investment are also fixed in real terms. This reduces the role of investments in economic growth, leaving trade policy effects as the major explanatory factor. Lastly, the income effects of changes in terms of trade is "neutralised" by making the coffee sector (Colombia's major export earner) exogenous. This is done by setting coffee tax constant and by setting coffee prices equal to world prices.

One important feature of this model is that it is one of the first to use the Armington assumption and to assume product differentiation between domestic and exported goods. The model sets composite price index as a numeraire. Therefore, the real exchange rate, defined as a relative price of imports and domestic goods, clears the balance of trade.

Simulations are carried out for three trade regimes assuming two types of wage formation: (1) flexible wages for all labour groups and (2) fixed real wages of agricultural labour and unskilled labour. The trade regimes can be summarised as (1) inward-looking, involving a 50% tariff increase in manufacturing sectors; (2) outward-looking, with a 50% subsidy to agricultural and manufacturing exports; (3) direct protection with a 50% subsidy on the value added in the manufacturing sectors.

The results of the model can be summarised as follows. Firstly, outward looking strategies by causing net prices to rise generate higher employment effects and factor incomes than inward looking strategies. This result is magnified where the real wage is fixed. Secondly, the relative gains or losses from a policy change depend on factor mobility. For example, sector-specific factors gain more in expanding sectors and lose in the contracting sectors relative to mobile factors. This result is in line with trade theoretic models, for example, Jones (1971) and Mussa (1974) which show that immobile factors gain (lose) relatively more than mobile factors as a result of expansion (contraction) of the economy. Lastly, the policy effect of income distribution measured by the Gini coefficient is found to be stable. This last result confirmed earlier results, especially Adelman and Robinson (1978) and Taylor et al. (1980) which showed that the policy changes affect the functional income distribution but leave size distribution largely unaffected.

The Cameroon model of Devarajan and Offerdal (1989) examines the implication of the assumptions about capital mobility; especially the assumptions of short-run sector-specificity of capital and long-run capital mobility. This is important because of the implications for the returns to capital. In the former case capital earns rents and in the latter case the mobility across sectors equalises returns to capital. These differences are conjectured to lead to sectoral differences in output levels, prices, exports and imports.

This model is typical of models now considered more realistic for modelling LDC trade policy issues. In particular, it assumes product differentiation between domestic goods and imported and exported goods; it also specifies an export demand function with less than infinite price elasticities. However, it maintains conventional Cobb-Douglas production and demand functions. Like de Melo and Robinson (1982) an attempt is made to concentrate only on the trade policy effects by fixing government consumption in real terms by lump-sum taxes or transfer to the consumers. Savings determine investments; and with foreign savings exogenously fixed, domestic savings are important.

In keeping with Cameroon's membership to the CFA Franc zone, the nominal exchange rate is fixed and used as a numeraire. This means that the real exchange rate is endogenously determined.

Two sets of experiments (involving increase in foreign savings and tariff reductions) are run under three assumptions of capital mobility. In assumption (1) capital is sector specific; in (2) it moves costlessly between sectors; and in (3) capital stock is determined by investments undertaken in the previous period.

This model shows that the different specifications of capital mobility do not have significant qualitative effect on the results. Tariff reductions lead to higher sectoral output and lower prices. Where capital is mobile these changes are only magnified. This is purely because with mobile capital, the expanding sectors will attract more factors; which lead to higher output and hence lower prices.

Grais, de Melo and Urata (1986) is unique in that it is one of very few studies which have attempted to estimate the costs of rationing and rent-seeking activities. This is done using "virtual" prices; defined as prices which induce unrationed households or firms to act as if faced with rationing constraints (Grais et al., p.67).

The model divides imports into three types: those subject to tariffs only, such as investment goods and government imports; those subject to tariffs and rationing but do not give rise to rent-seeking such as consumer goods; and those subject to tariffs and rationing and give rise to rent-seeking, mainly in intermediate inputs. Households are assumed to be rationed in their purchases of imports of consumer goods, while producers are rationed in their purchases of imports of intermediates. Guestimates of premium rates, assumed to be between 14 and 32% for consumer goods and 25 and 101% for intermediate inputs are used to determine the premiums arising from the import rationing of these two goods. Import premiums equivalent to 7 and 60 million Turkish liras are estimated to accrue to households and producers, respectively. It is assumed that only producers engage in rent-seeking activities. The base values of rents are estimated to be 6% of GNP.

Trade liberalisation is simulated in several stages: first, quotas (import premiums) are removed on the imports of intermediates; secondly, they are eliminated on consumer goods; and after all the quotas have been removed a 50% tariff reduction is applied across the board on imports. Each experiment is done with and without capital mobility.

The welfare gains from trade liberalisation are found to be about 5.0% of GDP. Most of these gains arise from quota reduction on intermediates. Little additional gains in real GDP are achieved by the removal of quotas on consumer goods or reduction in tariffs. This is because consumer goods form a small proportion of total imports. The usual result that tariff reductions generate low welfare gains is also confirmed. The model also shows that while real GDP is higher in the presence of mobile capital, the result is not qualitatively different from that of sector-specific capital.

Levy's (1987) model of Mexico analyses the economic effects of quota restrictions, especially on the balance of trade. The model assumes fixed nominal wages, a fixed exchange rate, sector-specific capital and excess capacity in some sectors.

The model has two consumers; workers whose income is only in the form of wages and capitalists who derive their income from profits (obtained as markups) and the rents arising from QRs. The two consumer groups have similar expenditure shares in the LES function.

Government consumption is fixed in real terms.

On the production side, with the assumption of excess capacity, the marginal cost is constant. Changes in output will no longer be associated with a declining marginal product of labour but will be determined through capacity utilisation. Moreover, returns to capital are now determined as a mark-up over wages and intermediate costs. In Levy's model the mark-up rate is endogenously determined by the level of imports and capacity utilisation.

In the external sector of the model, the small country assumption is followed in the case of imports. However, since "water in the tariff" (the possibility of domestic prices being lower than world prices) is allowed the "law of one price" need not hold. Export demand functions are specified as less than infinitely elastic.

The model has ten sectors which are further classified into three groups (1) primary goods : agriculture, and mining and oil extraction; (2) manufactures : food, textiles, chemicals and oil refining, glass and cement, metals and manufactures, and other manufactures; and (3) non-traded goods : electricity and transport, and services. Non-traded goods are specified along classical lines, that is, they are neither exported nor imported. The specification of trade policies differ among the sectors. Export subsidies accrue only to the manufacturing sectors, while export quotas are imposed on mining and export prohibition are applied to food and beverages. Non-uniform tariffs are imposed on imports and there are import bans on textiles. In the data for the stylised model import quotas are only applied to other manufactures. However, the simulations are done with two different assumptions about the quotas. The first assumes that quotas apply to all the sectors while the second assume that there are no quotas on chemicals and oils. It turns out that these specifications are significant. The import quotas are specified as a proportion of base imports; that is

$$M_i^q = \alpha_i M_i^o \tag{3.17}$$

where M_i^q and M_i^o are import quotas and base imports, respectively; and $\alpha_i \varepsilon [0, 1]$ is the proportional change of imports from base values. Hence, for $\alpha_i = 0$ there will be no imports and for $\alpha_i = 1$ there will be no quotas. The specification $\alpha_i \varepsilon [0, 1]$ therefore implies a continuum of import restrictions where as α_i declines the volume of competitive imports decline from their base values.

The mechanism in which the commodity markets are cleared depends on the tradability of the commodity and the effect of quotas. The excess demand for non-tradables is cleared by an increase in mark-up rates, while that of tradables with no quotas is cleared by changes in the trade balance. On the other hand, tradables with binding import quotas will behave as non-tradables and their excess demands will be cleared by price increases through higher mark-ups.

The model assumes excess capacity in the manufacturing and services sectors. Mark-up pricing technology therefore applies in these sectors; but the specification of technologies for those sectors operating at full capacity are not stated.

The results of the model are straightforward. In the case where all the imports are under QRs, as α_i moves from 1 to 0 (1) the price level rises as imports decline and this leads to lower real wages; (2) there is an increase in employment not only because of lower real wages but also because of increased demand for domestic inputs as imports are reduced; (3) increase in prices imply increase in mark-up rates and therefore higher in rents; (4) the balance of trade initially improves but as α_i approaches zero higher prices lead to lower exports thus worsening the balance of trade; and (5) a combination of higher cost of production and lower real income lead to lower real GDP. These results are however mitigated when quotas are not imposed on chemicals and oils, which are mostly intermediate inputs.

In conclusion, the model shows that increase in QRs (import compression) is very stagflationary. The inflation generated by lower imports lowers real incomes and increases production costs. It is also shown that the effect of QRs depend on the pattern of excess capacity. For example, where excess capacity exists in sectors which supply intermediate inputs, the effects of the quotas will be greater. The effects of import quotas on the balance of trade will depend on the level of the quotas. At lower levels the balance of trade will be improved, but as quotas increase their effect on the trade balance begins to be reversed and may lead to deficits if exports fall.

There have been few CGE models of the Kenyan economy. Although most of the existing models in one way or another deal with issues related to trade, only Blomqvist and McMahon (1984) model trade policies. Gupta and Togan (1984), Roe and Pal (1986), and Bevan, Collier and Gunning (1987) model the consequences of external shocks; while McMahon (1986, 1987) and Dick et al (1983) model commodity stabilisation programs. Our review of these models will therefore concentrate on their structure and less on the generated results.

Blomqvist and McMahon (1984) is more or less a textbook type CGE model. It is a two-sector model with the world prices of the two goods exogenously given. In the tradition of Harris-Todaro (1970) model, the two sectors, manufacturing and agricultural, employ two types of labour, urban and rural; with urban labour mainly employed the manufacturing sector. There is labour market distortion in formal sector (manufacturing), where the urban wage is fixed in terms of a composite of the prices of the two commodities. This assumes that urban labour unions have power to fix wages or that the government is interested in ensuring fixed real incomes for the urban workers. Although the model allows for unemployment in the formal sector, Blomqvist and McMahon assume that urban labour not employed in the formal sector would not remain unemployed but would be employed in the informal sector which produced a commodity similar to that produced in the agricultural sector. If one can accept the notion that agricultural goods can be produces in the urban sector, then the assumption serves the intended purpose of ensuring that the urban unemployed have non-zero incomes. The allocation of labour between rural and urban markets is determined by a Harris-Todaro migration equation.

Production is modelled as a CES aggregation of labour and capital. There are two classes of consumers: workers who earn wages and capitalists who earn profits. Both consumer also receive lump-sum transfers from the government.

The external closure of the model follows the traditional small country assumption, hence foreign and domestic goods are assumed to be perfect substitutes. This assumption implies that the balance of trade is covered by quantity adjustment. Foreign capital inflows are therefore allowed to supplement domestic savings.

The model is used to simulate the effects of second-best tariff policy in the presence of wage rigidity in the labour market and domestic tax distortions; with and without capital mobility. It is shown that policy choices depend on whether the urban wage is fixed in terms of agricultural or manufacturing goods. For instance, where the wage depends on the agricultural good the second best policy is an import tariff; whereas a subsidy would be the optimal policy where the wage is fixed in terms of the manufactured good. In the latter case a subsidy reduces the manufacturing wage. This induces return migration and hence increased employment and production in the agricultural sector. In the former case the effect of a tariff increase is to raise the price of manufactured goods relative to the urban wage. This increases employment and output in the sector. The implication for income distribution is that import subsidy redistributes income in favour of the workers while a tariff favours the capitalists. Moreover, import subsidy generates a higher GDP than a tariff.

It is also shown that the assumptions of capital mobility does not matter in terms of the efficiency gains of policy change. This result is in line with those of other studies, for example, Grais et al. (1986) and Devarajan and Offerdal (1989). The model also shows that removal of wage distortions lead to higher gains in real output. This leads to the conclusion that the optimal policy would be to remove the wage distortions.

Gupta and Togan (1984) analyse the relative response to external shocks by economies under different trade regimes using data for Turkey, Kenya and India. The trade regimes are classified as: (1) a liberal regime, characterised by flexible wages and exchange rates, together with 10% tariff reduction; (2) a semi-liberal regime where wages and exchange rate are flexible; and (3) a semi-interventionist regime, in which wages are flexible, but the exchange rate is fixed; and (4) interventionist regime where both wages and the exchange rate are fixed.

The production structure of the Gupta-Togan model is more elaborate than that of Blomqvist and McMahon. The four specified sectors: agriculture, consumer goods, manufacturing and services, are characterised by nested production functions. At the lower levels labour types are aggregated by CRESH functions and different land types combine to form aggregate land in a similar manner. In the middle level primary factors are combined to form value added using CRESH functions; while domestic and imported intermediates combine in CES to form aggregate intermediate inputs. Aggregate intermediate inputs and value added combine in the top level in IO functions to form gross output. It should be noted that both capital and labour are mobile across sectors.

On the consumption side the model specifies three consumer groups: farmers who earn land and labour income from the agricultural sector, non-agricultural labour which earns wage income, and capitalists who receive profits. Changes at the sectoral levels therefore directly affect the households' income and consumption. Consumption functions are specified in LES form.

The Armington assumption is used to model imports, with import supplies assumed to be infinitely elastic at given world prices. Export demand is however modelled as less than infinitely elastic.

The experiments are made by specifying external shocks as a 4.8% across the board increases in import prices and a 0.39% across the board decrease in the base values of the exogenous export demand. The results of the model tally closely with those predicted by export promotion type models. In particular, it is found that external shocks lead to higher loss of GDP under inward-looking policy regimes. Furthermore, functional income distribution favours the capitalists under these regimes; while the farmers and labour gain more under the outward-looking regimes. The political economy implication of these results is that the powerful urban elite will always work against trade liberalisation.

Bevan et al. (1987) is a dynamic model covering the period 1975-83. Using panel data, it examines the consequences of the coffee boom on economic growth and income distribution. It is a large model, with 36 commodities, 46 rural households and 8 urban households. This high disaggregation of commodities and households is clearly motivated by the desire to examine the redistributive effects of external shocks. Although, the study does not provide equations of the model, the verbal description of the model is sufficient enough to explain the results.

The thirty-six commodities are aggregated into four categories: exportables, mainly cash crops whose prices are exogenously determined in world markets; foods which are subject to tariffs but not quantitative restrictions; non-food importables, subject to quantitative controls and; non-tradables. The mechanism through which the excess demands for these commodities are cleared plays an important role in the redistribution of income between households. The pattern of income redistribution is also largely dependent on the sources of income and pattern of consumption of rural households. For example, rural households' incomes are generated from the sale of agricultural products, wage employment, and earnings from non-farm activities such as trading. These households consume own-produced foods, imported goods, and urban sector goods. Urban households obtain their income from formal sector wages or informal sector self-employment. The government revenue from direct and indirect taxes finances government consumption and investment.

The model assumes that capital is fixed and fully employed in the short-run. Changes in output levels therefore depend on changes in employment levels. Since real wages in the urban sectors are fixed (in terms of producer prices) they will decline only with a decline in product wages. The level of investment, assumed to be determined by savings, also affects output. Households are assumed to save a fixed share of their incomes; with urban household savings rate assumed to be higher than that of rural households. Household income transfers will therefore affect the level of investment. The model allows foreign savings to augment domestic savings.

The effects of the commodity boom are determined by comparing two simulations: (1) a "boom run" in which the export and producer prices of coffee and tea are kept at their actual values and (2) a "counterfactual run" in which the prices of the two commodities are assumed (set) to grow at the same rate as the price of non-oil imports over the period 1976-1980. Since the rest of the assumptions of the model are the same for the two runs, the differences in their results are therefore attributable to the increase in the prices of coffee and tea.

The model results show that the effect of the commodity boom was to increase GDP at factor cost by 4.4% in the short-run and 7% in the long-run; GDP at market prices was 6.6% higher than the base year values in 1983. The growth of GDP is due to increase in investments associated with increased savings.

The model results show that the coffee boom increased rural households' incomes by 21%. However, the relative price changes generated by the external shock reduced the rural households' real incomes to about 11.0%. The boom led to the excess demand for importable and non-traded goods, and therefore increased prices of these commodities since their markets are cleared by price changes. Since these goods are produced by the urban sector the price increase imply a movement of relative prices against rural households and therefore income redistribution in favour of urban households. Compared to rural households, the nominal incomes of urban households rose by 36% and the real incomes rose by 15%. Furthermore, since urban households' savings rate is high, the increase in their real income contributed to higher real investment growth. And with investment effects heavily biased in favour of the urban sector this worsens income inequality by increasing wage and profit incomes in the urban sectors.

McMahon (1986, 1987) model the costs and benefits of Kenya's membership of the International Coffee Agreement. Although the two models analyse different problems, the former simulating the effect of coffee price stabilisation on Kenya's export earnings and GNP and the latter the path of the economy with and without the coffee agreement, they are essentially the same. We shall henceforth concentrate on detailing the 1986 model. The other two studies, Dick et al (1982, 1983), covering the same issues, are not reviewed.

This is a dynamic model covering the period 1964-79. The four sectors specified by the model: coffee, non-coffee agriculture, secondary and tertiary, are characterised by different production functions. The last two sectors are production activities in the urban areas. Secondary and tertiary goods are produced by a CES aggregation of capital and labour, while labour and land combine to produce coffee and all three primary factors are used to produce agricultural goods. Within periods, labour is intersectorally mobile but the total supply is fixed. However, the urban wage is fixed in real terms and therefore unemployment is a possibility in the urban sector. On the other hand, capital and land are sector specific.

The adjustment equations linking the 16 years allow for the changes in these factors from year to year. For example, the labour force is assumed to grow by the rate of population growth (3%) and through the migration equation move from rural to urban areas (or vice versa) only at the end of each year. While land is fixed, the hectarage under coffee can change from year to year. Changes in capital stock in each sector are modeled using an investment allocation equation. It is assumed that investment is a function of the rate of return and the share of capital stock in each sector.

The model specifies four consumer groups: coffee labourers, agricultural labour, urban labour and the capitalists. The labour groups earn wage income and receive transfers from the government, while the capitalists receive all the profits. Since investment demand adjusts to available savings the fact that capitalists are assumed to be the only agents who can save implies that a policy that affects the income of this group will indirectly affect investments. This is especially true since the current account is exogenously fixed so that foreign savings play little role in augmenting domestic savings. It is also assumed that domestic and imported investment goods are imperfect substitutes. This means that investments depend on the degree of substitutability between domestic and imported capital goods.

Imports of secondary and tertiary goods, like investment goods, are assumed to be imperfect substitutes with domestic output. On the export side, all coffee is assumed to be exported and exports of agricultural goods are treated as a residual. On the other hand, exports of secondary and tertiary goods are assumed to be a function of relative prices and export demand elasticities.

To simulate the effects of coffee price stabilisation, coffee prices were allowed to rise by the actual average historical trend. Two assumptions are used to simulate the effects of stabilising the coffee prices around the trend. Firstly, it was assumed that the hectarage under coffee was restricted during the low price period, 1964 to 1972, but after 1972 was allowed to rise with coffee prices. Secondly, it was assumed that coffee prices and output was exogenously set by leading coffee producers, so that Kenya minimised on coffee production.

The study concludes that the price stabilisation program would have stabilised Kenya's export earnings and GNP. It is also shown that where the coffee quotas were not binding the gains were much higher. McMahon (1986, 1987) therefore argues that the Kenyan economy would have done better in the absence of the international coffee agreement.

Roe and Pal (1986) uses SAM data to construct a dynamic model (1972-82). This model is used to analyse Kenya's adjustment to the external shock associated with the oil crises of 1973/74 and 1980/81. Emphasis is placed on the impact of structural adjustment on sectoral performance and the pattern of income distribution.

The model has six sectors: agriculture, consumer goods, capital goods, intermediate goods, infrastructural goods, and services. Each sector is characterised by a series of nested production functions. Except for agricultural and manufacturing sectors, the production functions are specified in a similar fashion in all the sectors. There are four factors of production: wage labour, self-employed labour, land and capital.

In the agricultural sector, land and self-employed labour combine at the first level to form a composite factor, which combines with wage labour at the second level to form value added. Domestic and imported intermediates also combine in CES form in the second level to form a composite intermediate inputs; which combine with value added in fixed coefficients in the next level. The resulting output combine with infrastructural goods in CES form to produce gross output. This specification of the formation of gross output highlights the importance of infrastructural goods such as petroleum and electricity in the determination of sectoral output and hence incomes and employment. At the top level gross output combine with imported final goods in Leontief coefficients to form total supplies. The assumption here is that the two goods are complementary. In the case of the manufacturing sector domestic and imported capital goods combine with an elasticity of substitution of 0.5. The remaining sectors have a production structure similar to that of the agricultural sector except that at the lowest level the two labour categories together with capital combine to form value added.

The model assumes a fixed supply of labour, land and capital inputs with land and capital being sector specific. The two types of labour (waged and self-employed) are aggregated into urban and rural labour. All the labour employed in the agricultural sector are classified as rural, leaving those employed in the rest of the sectors as urban. It is assumed that wage adjustments clear the urban labour market, while the possibility of rural unemployment is allowed. It is assumed that the demand for rural labour is a function of a fixed wage differential between rural and urban wages. A major weakness of the specification of the labour markets, especially since it involves dynamic adjustments, is that it has no migration equation. While wage adjustments can reallocate labour in the urban sectors, there is no mechanism for meeting excess demand for rural labour. This will most certainly constrain output in the agricultural sector. Furthermore, the realism of assuming fixed wages in the rural sector is questionable. Unless one assumes that the agricultural sector is dominated by subsistence production, so that the fixed wage is a Ricardian type subsistence wage, there seems to be no other justification for the model's assumption.

The model specifies four households, a corporate sector and the government. The incomes of each institution is a fixed share of factors. Inter-institutional income transfers and payments of direct taxes are also modeled as fixed proportions of gross incomes. Non-factor payments to and from the Rest of the World (ROW) are exogenously fixed.

Household consumption of domestic goods is specified through the LES functions. On the other hand, consumption of imports is exogenously fixed. Investment demand and government consumption are also exogenously fixed.

As discussed above, imports of intermediate inputs and capital goods are treated as imperfect substitutes with domestic goods. It is through this specification that trade policy affects the supply side of the economy. On the export side, less than infinitely elastic export demand equations are specified for all goods; except infrastructural goods and services whose demand are assumed to be exogenously determined.

It should also be noted that because of import controls and fixed exchange rates, import prices (through adjustments in import license premia) adjust to clear the excess demand for imports and hence foreign exchange. This is therefore another channel through which the demand for intermediate inputs and capital good imports are affected. For example, a relaxation of import controls would reduce premia on import licenses leading to lower import prices and hence a lower cost structure.

The model is used to examine the effect of increased land availability, improvement in the terms of trade, increase in investments and improvement in resource allocation. Since these issues do not feature in our analysis we only report the model's results related to the experiment on improved terms of trade.

To determine the effects of external shocks, base run (1976-1982) results are compared with the simulation results. The simulations were made under the assumption that external shocks did not exist. The shocks associated with the commodity boom of 1977/78 were neutralised by setting changes in agricultural export prices equal to the changes in intermediate import prices; and the effects of the oil shock were neutralised by setting the changes in intermediate import prices in 1976-82 equal to the changes in 1972-75. Otherwise, other changes in the model remained the same as those of the base run. However, two important assumptions were made: (1) foreign capital inflows were set at $90m, and (2) investments were specified as endogenously determined.

The results of the simulations show that economic growth would have been higher in the absence of external shocks. This is manifested by the increase in investment by an average of 14% per year over the period under study. This growth is however mainly concentrated on the capital goods sector; the major user of investment goods. This sector grew by an average of 11% while the agricultural sector grew by 0.8% and the services sector declined by an average of 3.2%. It is also shown that urban households do not benefit from the increase in output, and that in fact the share of these households' income in total household income declined by 3.5% in 1982. However, private consumption rose by 3-13% in all but the last two years. The model results also shows that because of lower relative prices imports of all the goods rise. The volume of exports also go up due to lower export prices and the implied increase in demand associated with the specified downward sloping export demand function.

It is clear that the simulated growth of output is largely dependent on the increase in investments. Given lower household incomes and increased private consumption (and government consumption exogenously fixed to base values), foreign rather than domestic savings finances the increase in investments. This is accounted for by the exogenously determined capital inflow and the increase in imports. With the SAM data showing that almost all imported capital goes to the capital goods sector, it is not surprising that this sector benefits the most from the increase in investment.

CHAPTER FOUR

THE MODEL SAM FOR KENYA

4.1 Introduction

This chapter discusses the data and the model used for empirical analysis in this study. The transformation of the original data to fit objectives of the study is systematically analysed. The source of the data is the revised 1976 Social Accounting Matrix (SAM) for Kenya.[1/] These data are supplemented with data from the 1976 Input-Output Tables of Kenya.[2/] The CGE model will be developed using the Transactions Value (TV) approach introduced by Drud, Grais, and Pyatt (1986).

The choice of 1976 as a base year has been dictated by the availability of a consistent data set. A recent SAM for Kenya is not available and due to lack of adequate data it has not been possible to construct an alternative. The use of the SAM data in our general equilibrium analysis assumes that the economy was in equilibrium in 1976. This assumption while appearing unrealistic may not be so for two reasons. Firstly, it would appear that by 1976 the Kenyan economy had recovered from the external shocks associated with the oil crisis of 1973. Secondly, it can be argued that the effects of the commodity boom which began in 1976 had not had substantial disequilibrium effects on the economy by the end of the year. These assertions are surported by the World Bank (1983) which shows that GDP at factor cost (1972 prices) was back to 1973 levels in 1976; and by Killick (1984) which shows that the inflation rate was close to the 1973 level in

1976 and only increased thereafter.

The 1976 SAM data has been used in a few other studies. None of these studies however examines the issues we do. Mwega (1985) used the data set to analyse the incidence of taxation in Kenya, while Roe and Pal (1986), as discussed earlier, used it to study Kenya's adjustment to the oil shocks of 1973 and 1979. The data has also been used by McMahon (1989) to study the income distribution effects of Kenya's coffee marketing system and by van der Hoeven (1987) and Vandermoortele (1987) to analyse basic needs issues. Among these studies Mwega, Roe and Pal, and McMahon are CGE based models. Vandermoortele has modified this data set to provide a fuller account of income distribution among households and the distribution of benefits from public expenditures. However, his high aggregation of the manufacturing sector does not allow us to use an otherwise improved data set.

For the purposes of this study the 77 by 77 original SAM is initially aggregated into 19 by 19 matrix. This is done by consolidating various SAM's accounts.[3/] There are no a priori theoretical guidelines as to how to consolidate SAM accounts. In practice, the exercise depends on the type of issues to be addressed. For example, Mwega's interest in the incidence of taxes, especially production taxes leads him to retain a higher disaggregation of the manufacturing sector. To the contrary, Vandermoortele's concern for poverty issues leads him to have a highly aggregated manufacturing sector and a highly disaggregated service sectors. Since both studies are concerned with income distribution they have maintained a highly disaggregated institutional structure. Our concern for the trade policy issues is therefore reflected by the way we have aggregated the SAM. In this respect those sectors directly affected by trade policy changes are given a more prominent role than in the aggregation. The fact that we are interested in income distribution issues only in so far as they arise from trade policy changes has led us to specify a simpler institutional structure than the above mentioned studies.

4.2 The SAM

4.21 Data SAM

The original SAM has five types of labour, two types of capital, ten types of households, two types of companies and governments, and twenty eight accounts for production activities. It also has accounts for indirect taxes, the rest of the world (ROW), gross fixed capital formation, and assets. Our aggregation and modification of the data SAM revolve around these accounts. Table 4.1 shows how the 1976 SAM has been aggregated.

The original seven factor accounts have been consolidated into three accounts; unskilled labour, skilled labour and capital. It is worth noting that incomes of self-employed labour are recorded in the national accounts, and indeed in the 1976 I-O tables, as part of the net operating surplus. This led to a heated debate in Hodd (1976, 1978), House and Killick (1978) and Hodd, House and Killick (1978) which culminated with the consensus that the national accounts data could not be used to analyse functional income distribution. This shortcoming is corrected in the SAM data so that the incomes of self-

TABLE 4.1

The Aggregation of the Original SAM

DATA SAM CLASSIFICATION	1976 SAM CLASSIFICATION
A. Factors	
(1) Unskilled labour (ULBR)	(1) Unskilled and Semiskilled workers (5) Self employed and family workers
(2) Skilled labour (SLBR)	(2) Skilled workers (3) Office workers and semi-professionals (3) Office workers and semi-professionals (4) Professionals
(3) Capital	(6) Operating surplus (7) Consumption of fixed capital
B. Institutions (Current Account)	
(4) Urban Households (UHSD)	(9) Household income <Sh6000 P.A. (10) Household income Sh6000<Sh20000 P.A. (11) Household income≥Sh20000 P.A.
(5) Rural Households (RSHD)	(12) Holding <0.5ha. with little additional income (13) Holding <0.5ha. with substantial additional income (14) Holding ≥0.5 but <1.0 ha. with little additional income (15) Holding ≥0.5 but <1.0 ha. with substantial income (16) Holding ≥1.0<8.0 ha. (17) Holding ≥8.0 (small farms only) (18) Other rural
(6) Companies (COMP)	(19) Private companies and non-profit institutions (20) Parastatal bodies and public companies
(7) Government (GOVT)	(21) Central Government (22) Local Government
C. Consolidated Capital	
(8) SAV-INV	Gross fixed capital formation
D. Indirect Taxes	
(9) ITAX	(8) Indirect taxes
E. Activities	

(10) Agriculture (AGR)	(23) Traditional economy (24) Agricultural (25) Forestry and Fishing
(11) Foods (FOOD)	(27) Food and beverages
(12) Consumer Goods (CON)	(28) Textiles, wearing apparel and leather (29) Wood and wood products (30) Paper, paper products, printing and publishing
(13) Petroleum (PETR)	(26) Mining and quarrying (31) Petroleum and refineries
(14) Chemicals (CHEM)	(32) Other chemicals (33) Non-metallic minerals
(15) Manufactured Goods (MAN)	(34) Metal products, machinery (35) Miscellaneous manufacturers
(16) Construction (CONS)	(38) Building and construction
(17) Private services (PSRV)	(39) Wholesale and retail (40) Hotels and restaurants (41) Transport and services allied to transport (36) Electricity (37) Water (42) Communications (43) Finance, real estate, insurance and business (44) Ownership of dwelling (45) Other services including domestic services
(18) Government Services (GSRV)	(46) Public administration and defence (47) Education (48) Health (49) Agricultural services (50) Other Services

F. Rest of the World

(19) ROW	(51) Goods and non-factor services and transfers (52) Factor services and transfers

Source: Kenya (1981), Social Accounting Matrix 1976 (revised).

employed and hence unskilled workers are fully accounted for.

In the original SAM, households are distinguished by origin, that is, whether they are rural or urban; and further by income, and the size of landholding in the case of urban and rural households, respectively. For our purposes we only distinguish between rural and urban households. If we were mainly interested in modelling income distribution then we would have stayed as close as possible to the original aggregation. However, this aggregation still enables us to analyse functional and institutional income distribution since it maintains an adequate mapping from factorial incomes to the institutions *and between institutional incomes.*

The government account is an aggregation of local and central governments, while that of companies is an aggregation of private and public enterprises. Companies own capital and as we shall discuss later neither produce nor consume. This avoids the confusing claim by Mwega (1985) that they maximise profits. Such an assumption leads to the argument as to whether public and private companies should be aggregated. This conceptual problem does not arise in our analysis because we assume, like the SAM, that only activities produce. Furthermore, the Kenya SAM does not distinguish between public and private activities which reduces the need to differentiate between public and private companies.

The twenty eight production activities are aggregated into nine sectors; agriculture (AGR), food, consumer goods (CON), petroleum (PETR), chemicals (CHEM), manufacturing (MAN), construction (CONS), private services (PSRV), and Government services (GSRV). The dominance of the industrial sectors reflects our concern for the role of trade policy in protection. The number of sectors have been limited to reduce computation costs and complications. However, in aggregating the activity accounts an attempt has been made to satisfy the so-called Hicks composite theorem. This theorem asserts that a group of commodities can be aggregated into a single commodity if they have the same price. A weaker version of this theorem, which states that goods can be combined into a composite if their prices move in a fixed ratio to each other, would be sufficient in most cases.

Table 4.1 also shows how other accounts, namely, indirect taxes, combined capital (savings and investments), and the rest of the world (ROW) have been aggregated. The model used in this study, like most CGE models, is Walrasian in the sense that it only models the real side of the economy. This means that the aggregated SAM does not include the financial sector.

Table 4.2 is the data SAM obtained by aggregating the original 1976 SAM. This SAM (like other SAMs) has several important characteristics. Firstly, it is a square matrix. Notice that each corresponding row and column is identically labelled. Let the cell element t_{ij} be the intersection of the i_{th} row and the j_{th} column in any account; by convention i and j represent the receipts and payments to the account, respectively. The column and row vectors (Y_i) are obtained by summing over the rows and the columns in each account; that is

$$\sum_i t_{ij} = Y_i = \sum_j t_{ij} = Y_i \qquad i,j=1,2,\ldots,n \qquad (4.1)$$

TABLE 4.2

Data SAM

	1 ULBR	2 SLBR	3 CAPITAL	4 RHSD	5 UHSD	6 COMP	7 GOVT	8 SAV-INV	9 ITAX	10 ACT-AGR	11 ACT-FOOD	12 ACT-CON	13 ACT-PETR	14 ACT-CHEM	15 ACT-MAN	16 ACT-CONS	17 ACT-PSRV	18 ACT-GSRV	19 ROW	20 TOTAL
1 ULBR										374.6	8.2	10.2	0.8	3.1	8.0	14.5	85.9	38.1		543.4
2 SLBR										7.6	13.6	12.7	1.9	9.7	15.9	24.6	127.0	144.7	1.8	359.5
3 CAPITAL										159.9	31.6	13.1	5.8	20.8	14.4	7.1	140.4	1.9	12.5	407.5
4 RHSD	412.2	97.5	14.6	5.6	10.9	86.5	4.3												3.4	635.0
5 UHSD	131.2	249.6	0.0			77.4	4.6												1.9	464.7
6 COMP			320.9	3.2	3.6	16.4	12.3												8.0	364.4
7 GOVT			2.0	37.6	44.6	79.5	7.3		175.5										16.5	363.0
8 SAV-INV				48.0	19.5	97.3	77.5												51.9	294.2
9 ITAX										2.4	42.5	11.8	6.7	7.9	22.0	0.4	14.8	0.5	66.5	175.5
10 ACT-AGR				262.6	27.9			39.9		30.1	104.3	2.3	0.0	6.3	0.0	0.0	0.4	0.5	153.9	628.2
11 ACT-FOOD				103.5	52.8			1.2		6.0	81.4	3.0	0.0	12.4	0.5	0.0	43.8	22.3	36.2	363.1
12 ACT-CON				33.6	19.7			5.7		4.6	10.3	28.9	0.7	2.9	2.7	4.9	12.6	5.3	18.2	150.1
13 ACT-PETR				4.1	3.6			0.1		4.4	4.5	3.4	2.7	6.2	3.9	20.2	33.8	5.2	47.9	140.0
14 ACT-CHEM				21.3	17.3			0.0		6.9	3.6	3.7	0.8	8.1	5.2	18.8	3.7	1.6	32.5	123.5
15 ACT-MAN				10.0	13.1			30.5		2.2	7.0	5.0	0.7	3.8	27.1	19.1	29.3	3.3	13.7	164.8
16 ACT-CONS				0.1	0.3			114.0		0.0	1.2	0.8	0.5	0.7	0.7	20.5	6.0	17.9	0.0	162.7
17 ACT-PSRV				78.3	154.6			7.3		13.7	27.9	18.7	2.6	9.1	16.4	17.4	135.7	21.2	168.1	671.0
18 ACT-GSRV				6.8	7.1		253.8	0.0		0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.2	269.7
19 ROW		12.4	70.0	20.3	89.7	7.3	3.2	95.5		15.5	26.6	36.5	116.8	32.5	48.1	15.2	37.6	7.1		
20 TOTAL	543.4	359.5	407.5	635	464.7	364.4	363	294.2	175.5	628.2	363.1	150.1	140	123.5	164.9	162.7	671	269.7		

where n is the dimension of the SAM. Equation (4.1) therefore shows that for each account income always equals expenditure. Furthermore, since a SAM is a snapshot of the country's economic activity during an accounting period (in our case one year), then summing over all accounts $(\sum_i y_i = \sum_j y_i)$, (4.1) represents equality between national income and national expenditure.

Although Table 4.2 is balanced and is therefore a true representation (model) of the Kenyan economy in 1976 it has limited modelling capabilities. This limitation arises from the way the original SAM was constructed. In particular, some of the accounts are aggregated in a manner that does not represent realistic behaviour and the constraints faced by agents in the economy. It is therefore necessary to transform this data SAM before it can be used for modelling purposes. This process is started initially by disaggregating Table 4.2 in such a way that not only makes more economic sense, but also makes later disaggregation easier.

The activity accounts (columns 10-18) combine the two types of labour and capital (rows 3-4) with domestic (rows 10-18) and imported (row 19) intermediate inputs to produce gross output (row 20). After paying indirect taxes (row 9) the activity accounts sell their output in the commodity markets (rows 11-18) for final consumption (columns 4, 5 and 7), capital formation (column 8), intermediate consumption (columns 10-18), and exports (column 19). The fact that activities can sell in the commodity markets implies a one-to-one correspondence between activities and commodities. This assumption is unrealistic for two reasons. Firstly, there is no a priori justification that activities should equal commodities. For instance, if some imported goods were non-competitive then the number of commodities would be greater than activities. Secondly, the scope for modelling producer and consumer behaviour is limited where activities are not separated from commodities. The modelling of producer behaviour, for instance, is best done along the activity accounts; while consumer behaviour is modelled through the commodity accounts.

To separate gross output from commodities, commodity accounts are created. The activity accounts would then sell gross output to these accounts at producer prices; which in turn would supply the goods to the appropriate users at market prices after paying indirect taxes and imposing mark-ups for trade and transport margins. The advantage of this specification is that it allows commodities which command different prices to be sold in different markets. For instance, it is common to separate the domestic and export markets for gross output because their prices will diverge unless they are perfect substitutes.

Another weakness of Table 4.2 as a model SAM can be seen by examining the relationship between domestic agents and ROW. Along row 19 ROW receives factor income transfers (columns 2 and 3), payments for goods and services and income transfers from households (columns 4 and 5), and income transfers from government and companies (columns 6 and 7). It also receives payments for imports of capital goods (column 8) and intermediate inputs (columns 10-18). The way these transactions have been recorded is not amenable for modelling purposes.

To start with, notice that the receipt of K£20.3m and

K£89.7m by ROW from rural and urban households, respectively, represent payments for goods and services and income transfers. This mixture of payments and income transfers assumes that households' decisions concerning commodity consumption and income transfers are similar. This is not theoretically justifiable. In our model we assume that while commodity demand is a function of relative prices, households transfer a fixed share of their income to ROW. For this reason households' income accounts should be separated from consumption accounts. The table also shows that households import consumer goods directly from ROW. This assumption makes it difficult to model tariffs and also the substitution between domestic and imported goods. As will be shown later, we assume that all imports are bought by the commodity accounts which pay import duties before releasing the goods to the domestic market.

To accommodate the changes in the assumptions, imports of goods and services and transfer payments are first separated; and then imported consumer goods are combined with domestic consumer goods to form total household consumption. The original SAM shows that rural and urban households transfer income to ROW amounting to K£1.8m and K£11.4m., and import goods worth K£18.5m and K£78.3m, respectively. The income transfers are recorded in the income accounts of each household. The SAM however does not show how much of each imported commodity is consumed by each household. Imports of consumer goods are obtained from the end-use analysis table of the I-O tables. The consumption of these goods by each household is then crudely estimated as a proportion of total consumption.

The intersection of row 19 and column 8 shows that goods for fixed capital formation worth K£95.5m are imported. As in the case of consumer goods we also assume that the combined capital account does not buy directly from ROW. This assumption is satisfied by distributing these imports along the rows of the combined capital account. The end-use analysis table of the I-O tables shows that 99 percent of these imports are manufactured (capital) goods. They are therefore all allocated to the commodity manufactures.

The activity accounts obtain intermediate inputs from domestic and foreign sources. Notice that while domestic intermediates are recorded by sector of origin, the imports are recorded as a composite commodity. Modelling aggregation of intermediates with these composite imports would force us to assume that domestic and imported intermediates are complementary. Although frequently used in structuralist models, this would be a highly restrictive assumption. In our model we want to allow for the possibility of substitution between these inputs. This specification would still allow us to assume complementarity of some inputs if we so choose. The change in assumption requires further modification of the data in Table 4.2. This is done in two stages. First, imported intermediate inputs are disaggregated by sector of origin using the information contained in the import matrix table of the I-O tables. The values of each imported intermediate input are then distributed to their corresponding rows and columns in the activity accounts so that the absorption matrix is now a composite of imported and domestic inputs. This is done simply by superimposing the input-output matrix of imported intermediates to the I-O matrix of the SAM which previously only contained domestic intermediates. With this change the activity accounts will no longer be importing directly from ROW;

hence in the second stage a commodity account which deals directly with ROW is created. This new account will not only import intermediate inputs, but also goods for final consumption and capital formation. However, total imports of each commodity are not given by the SAM. These data are again obtained from the input-output table.

Table 4.3 is a result of the disaggregation of Table 4.2. It is called a partial model SAM because it is not disaggregated enough to be useful for modelling purposes. It will be shown in Section 3.22 that modelling trade issues requires further disaggregation of this table. The more fundamental weaknesses of the original SAM have however been corrected.

Table 4.3 shows the new income (columns 4, 6 and 9) and consumption (5, 7 and 10) accounts of the households and government. The separation of the monetary and real accounts facilitates a more meaningful modelling of the agents behaviour. The activity accounts now sell gross output to the new commodity accounts at producer prices (as shown by the intersection of columns 22-30 and rows 13-21). The fact that the make-matrix is diagonal implies that each activity produces only one good; that is, there is no joint production. The commodity accounts then prepare these goods for the market by paying commodity taxes in row 12. These accounts also import commodities (row 31) at c.i.f. prices. These commodities are then valued at market prices through the payment of import duties which, for the moment, are recorded together with the indirect taxes on domestic products. This eliminates the K£66.5m recorded in Table 4.2 (row 9 and column 19) as payments by ROW to the indirect tax account; and therefore corrects the misconception that ROW met the tariff charge.

The intersection of columns 13-21 and rows 1-3 of Table 4.3 shows the generation of value added by production activities. The value added accrues to the three factors of production as factorial (functional) income. Unskilled labour, skilled labour, and capital earn K£543.4m, K£357.7m, K£395.0m, respectively. These add up to total GDP at factor cost of K£1296.1m. The table also shows that skilled labour and capital earned K£1.8m and K£12.5m from the ROW, respectively, which combine with GDP at factor cost to form total factor incomes of K£1310.2m.

The factorial income is distributed to domestic institutions and the ROW in columns 1-3. Unskilled labour account pays K£412.2m to rural households and K£131.2m to urban households; while the skilled labour account pays K£95.5m to rural households and K£249.6m to urban households. As would be expected the major source of rural households' income is unskilled labour and that for urban households is skilled labour. To be more precise 75% of total unskilled labour income accrues to rural households while over 69% of skilled labour income accrue to urban households. Skilled labour account also pays K£12.4m to the ROW for imported labour services.

The table also shows that 79% of the returns to capital accrues to companies (K£320.9m) and over 11% accrues to foreigners (K£70.0m) as distributed profits. The remainder goes to rural households (K£14.6m) and the government (K£2.0m) with urban households apparently not owning any capital. This distribution of capital earnings shows the importance of foreign capital in the Kenyan economy.

TABLE 4.3

Partial Model SAM

	1 ULBR	2 SLBR	3 CAPITAL	4 RHSDY	5 RHSDC	6 UHSDY	7 UHSDC	8 COMPY	9 GOVTY	10 GOVTC	11 SAV-INV	12 ITAX	13 ACT-AGR	14 ACT-FOOD	15 ACT-CON	16 ACT-PETR	17 ACT-CHEM	18 ACT-MAN	19 ACT-CONS	20 ACT-PSRV	21 ACT-GSRV	22 COM-AGR	23 COM-FOOD	24 COM-CON	25 COM-PETR	26 COM-CHEM	27 COM-MAN	28 COM-CONS	29 COM-PSRV	30 COM-GSRV	31 ROW	32 TOTAL
1 ULBR													374.6	8.2	10.2	0.8	3.1	8.0	14.5	85.9	38.1											543.4
2 SLBR													7.6	13.6	12.7	1.9	9.7	15.9	24.6	127.0	144.7										1.8	359.5
3 CAPITAL													159.9	31.6	13.1	5.8	20.8	14.4	7.1	140.4	1.9										12.5	407.5
4 RHSDY	412.2	97.5	14.6	5.6		10.9		86.5	4.3																						3.4	635.0
5 RHSDC				538.8																												538.8
6 UHSDY	131.2	249.6						77.4	4.6																						1.9	464.7
7 UHSDC						374.7																										374.7
8 COMPY			320.9	3.2		3.6		16.4	12.3																						8.0	364.4
9 GOVTY			2.0	37.6		44.6		79.5	7.3			175.5																			16.5	363.0
10 GOVTC									253.8																							253.8
11 SAV-INV				48.0		19.5		97.3	77.5																						51.9	294.2
12 ITAX																						3.1	46.5	23.4	26.0	13.3	47.2	0.4	14.8	0.8		175.5
13 ACT-AGR																						625.8										625.8
14 ACT-FOOD																							320.6									320.6
15 ACT-CON																								138.3								138.3
16 ACT-PETR																									133.3							133.3
17 ACT-CHEM																										124.6						124.6
18 ACT-MAN																											142.9					142.9
19 ACT-CONS																												162.3				162.3
20 ACT-PSRV																													656.2			656.2
21 ACT-GSRV																														269.2		269.2
22 COM-AGR					262.9		29.9				39.9		31.6	108.7	4.4	0.0	8.0	0.1	0.0	0.5	0.5										153.9	640.4
23 COM-FOOD					105.8		62.3				1.2		6.0	87.1	3.0	0.0	14.7	0.5	0.0	45.5	22.4										36.2	384.7
24 COM-CON					37.9		37.8				5.7		6.2	11.7	52.6	0.7	3.6	3.2	5.5	13.8	5.9										18.2	202.8
25 COM-PETR					4.2		3.9				0.1		5.0	5.4	3.7	117.2	9.7	4.6	21.7	38.8	5.8										47.9	268.0
26 COM-CHEM					22.3		21.5				0.0		17.0	13.1	10.3	2.1	29.1	11.5	21.6	5.9	3.0										32.5	189.9
27 COM-MAN					14.8		33.3				126.0		3.0	11.0	8.2	1.2	6.3	67.0	29.1	34.5	4.8										13.7	352.9
28 COM-CONS					0.1		0.3				114.0		0.0	1.2	0.8	0.5	0.7	0.7	20.5	6.0	17.9										0.0	162.7
29 COM-PSRV					82.3		171.3				7.3		14.6	28.6	19.3	3.1	9.9	17.0	17.7	158.4	23.6										168.1	721.2
30 COM-GSRV					8.5		14.4			253.8	0.0		0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6										1.0	279.0
31 ROW		12.4	70.0	1.8		11.4		7.3	3.2													11.5	17.6	41.1	108.2	61.0	152.8	0.0	50.2	9.2		
32 TOTAL	543.4	359.5	407.5	635.0	538.8	464.7	374.7	364.4	363.0	253.8	294.2	175.5	625.8	320.6	138.3	133.3	115.6	142.9	162.3	656.7	269.2	640.4	384.7	202.8	267.5	198.9	352.9	162.7	721.2	279.2		

Institutional transfer and income distribution are shown in the intersection of columns and row accounts 4-11. These accounts also show institutional allocation of income to consumption. Rural households transfer K£5.6m of their income to other rural households and allocate K£538.9m to consumption. They also transfer K£3.2m to companies, K£1.8m to foreigners and K£37.6m to the government as direct taxes, contributions to pensions and social security fund, and fines and fees. Similarly the government transfers K£8.9m to both households as pensions, scholarships, etc., K£12.3m to companies, K£3.2m to ROW, and K£7.3m to government mainly as grants to local governments. Income transfers and distribution by urban households and companies can be interpreted in a similar fashion. Apart from transferring income abroad, domestic institutions also receive transfers from abroad. For example, both households receive a total of K£5.3m from the ROW as remittances, while companies receive K£8.0m and the government receives K£16.5m as grants. Row 12 shows that part of the institutional income is saved. Rural households, urban households, companies and the government save 7.6%, 4.2%, 26.7% and 21.3% of their incomes, respectively. All the savings are collected for investment by the combined capital account (SAV-INV). This is shown in column 11 where the capital account buys investment by sector of origin. The SAM however does not allow us to disaggregate investments by sector of destination. This means that modelling of investments in our model will be rather simple.

The link between payments to factors by activities and the subsequent functional income distribution and institutional income transfers is important for policy purposes. This is because a policy which affects production activities will also affect the returns to factors. This in turn will affect institutional income and consumption. The implication of all these for modelling purposes is that the mapping from activities to factors should be explicit and realistic.

On the production side, activities combine (column 13-21) value added with intermediate inputs to produce domestic gross output. For example, the agricultural sector combines K£542.1m of value added (made up of unskilled labour, skilled labour and capital valued at K£374.6m., K£7.6m., and K£159.9m., respectively) with K£83.7m intermediates to form K£625.8m worth of gross output. This is sold to commodity agriculture account (column 21) at producer prices. This account then prepares the commodity for sale by paying an indirect tax of K£2.4m on it. However, before the commodity is sold it is combined with imported goods to form a composite commodity. In our example, agricultural goods worth K£11.5m are imported. Like domestic agriculture, imported agriculture is prepared for the market through the payment of import duty of K£0.7m. The total indirect taxes on agriculture then add up to K£3.1m. The domestic and imported commodity are then combined to form total supply of the agricultural goods (valued at market prices) worth K£640.4m. Commodities are sold in rows 22-31 to meet demands for final consumption (columns 5, 7, 11), investments (column 12), intermediates (columns 13-21), and for exports (column 31). Notice that in Table 4.3 unlike in Table 4.2 households now buy imported goods from the commodity accounts.

Accounts for final consumption display interesting patterns of institutional consumption. Companies do not consume commodities and the government only consumes government services. The pattern of the government's consumption reflects its role as a major provider of services. It is also evident that while urban households consume a lower proportion of agricultural goods they consume a large share of private services, manufactures and government services. On the other hand, rural households consume a large proportion of foods and agricultural goods.

Kenya's economic transactions with ROW are shown on column and row 31. Exports are shown as the intersection of the column account and the commodity rows 21-30. Total exports of goods and services amount to K£471.7m which when compared to payments for imports of goods and services worth K£461.1m leaves a balance of trade surplus of K£10.1m. However, when capital transfers are taken into account the result is a K£51.9m balance of payments deficit. This deficit is recorded as savings from ROW (intersection of row 11 and column 31) and therefore acts as a balancing item in the system. This is shown by the fact that total investments in column 11 amounts to K£294.2m, while institutional savings amount to K£242.3m. This leaves a deficit of K£51.9m. Since the macroeconomy is closed when savings equal investments foreign savings act as the equilibrating mechanism.

4.22 Model SAM

The complete model SAM is represented by Table 4.4. This table with 78 accounts is a blown up version of the partial model SAM which has only 31 accounts. It is worth mentioning however that no new data has been used for this disaggregation. New accounts have been created simply by separating and relabelling some elements of the old accounts and/or by combining some of the old accounts.

TABLE 4.4

Model SAM

	1 ULBRD	2 SLBRD	3 SLBRF	4 ULBRT	5 SLBRT	6 CAPITALF	7 CAPITALT	8 RHSDY	9 RHSDC	10 UHSDY	11 UHSDC	12 COMPY	13 GOVTY	14 GOVTC	15 SAV-INV	16 I-TAX	17 AL-AGR	18 AL-FOOD	19 AL-CON	20 AL-PETR
1 ULBRD																	374.6	8.2	10.2	0.8
2 SLBRD																	7.6	13.6	12.7	1.9
3 SLBRF																				
4 ULBRT	543.4																			
5 SLBRT		357.7	1.8																	
6 CAPITALF																				
7 CAPITALT						12.5														
8 RHSDY				412.2	97.5		14.6	5.6		10.9		86.5	4.3							
9 RHSDC								538.8												
10 UHSDY				131.2	249.6							77.6	4.6							
11 UHSDC										374.7										
12 COMPY							320.9	3.2		3.6		16.4	12.3							
13 GOVTY							2.0	37.6		44.6		79.5	7.3			175.5				
14 GOVTC													253.8							
15 SAV-INV								48.0		19.5		97.3	77.5							
16 I-TAX								16.9		18.6		63.6								
17 AL-AGR																				
18 AL-FOOD																				
19 AL-CON																				
20 AL-PETR																				
21 AL-CHEM																				
22 AL-MAN																				
23 AL-CONS																				
24 AL-PSRV																				
25 AL-GSRV																				
26 CAP-AGR																				
27 CAP-FOOD																				
28 CAP-CON																				
29 CAP-PETR																				
30 CAP-CHEM																				
31 CAP-MAN																				
32 CAP-CONS																				
33 CAP-PSRV																				
34 CAP-GSRV																				
35 ACT-AGR																				
36 ACT-FOOD																				
37 ACT-CON																				
38 ACT-PETR																				
39 ACT-CHEM																				
40 ACT-MAN																				
41 ACT-CONS																				
42 ACT-PSRV																				
43 ACT-GSRV																				
44 COM-AGRD																				
45 COM-FOOD																				
46 COM-COND																				
47 COM-PETRD																				
48 COM-CHEMD																				
49 COM-MAND																				
50 COM-CONSD																				
51 COM-PSRVD																				
52 COM-GSRVD																				
53 COM-AGRX																				
54 COM-FOODX																				
55 COM-CONX																				
56 COM-PETRX																				
57 COM-CHEMX																				
58 COM-MANX																				
59 COM-PSRVX																				
60 COM-GSRVX																				
61 COM-AGRM																				
62 COM-FOODM																				
63 COM-CONM																				
64 COM-PETRM																				
65 COM-CHEMM																				
66 COM-MANM																				
67 COM-PSRVM																				
68 COM-GSRVM																				
69 COM-AGRC									262.9		29.9				39.9					
70 COM-FOODC									105.8		62.3				1.2					
71 COM-CONC									37.9		37.8				5.7					
72 COM-PETRC									4.2		3.9				0.1					
73 COM-CHEMC									22.3		21.5				0.0					
74 COM-MANC									14.8		33.3				126.0					
75 COM-CONSC									0.1		0.3				114.0					
76 COM-PSRVC									82.3		171.3				7.3					
77 COM-GSRVC									8.5		14.4			253.8	0.0					
78 ROW					12.4		70.0	1.8		11.4		7.3	3.2							
79 TOTAL	543.4	357.7	1.8	543.4	359.5	12.5	407.5	651.9	538.8	483.3	374.7	428.2	363.0	253.8	294.2	175.5	382.2	21.8	22.9	2.7

	21 AL-CHEM	22 AL-MAN	23 AL-CONS	24 AL-PSRV	25 AL-GSRV	26 CAP-AGR	27 CAP-FOOD	28 CAP-CON	29 CAP-PETR	30 CAP-CHEM	31 CAP-MAN	32 CAP-CONS	33 CAP-PSRV	34 CAP-GSRV	35 ACT-AGR	36 ACT-FOOD	37 ACT-CON	38 ACT-PETR	39 ACT-CHEM
1 ULBRD	3.1	8.0	14.5	85.9	38.1														
2 SLBRD	9.7	15.9	24.6	127.0	144.7														
3 SLBRF																			
4 ULBRT																			
5 SLBRT																			
6 CAPITALF																			
7 CAPITALT						159.9	31.6	13.1	5.8	20.8	14.4	7.1	140.4	1.9					
8 RHSDY																			
9 RHSDC																			
10 UHSDY																			
11 UHSDC																			
12 COMPY																			
13 GOVTY																			
14 GOVTC																			
15 SAV-INV																			
16 I-TAX																			
17 AL-AGR															382.2				
18 AL-FOOD																21.8			
19 AL-CON																	22.9		
20 AL-PETR																		2.7	
21 AL-CHEM																			12.8
22 AL-MAN																			
23 AL-CONS																			
24 AL-PSRV																			
25 AL-GSRV																			
26 CAP-AGR															159.9				
27 CAP-FOOD																31.6			
28 CAP-CON																	13.1		
29 CAP-PETR																		5.8	
30 CAP-CHEM																			20.8
31 CAP-MAN																			
32 CAP-CONS																			
33 CAP-PSRV																			
34 CAP-GSRV																			
35 ACT-AGR																			
36 ACT-FOOD																			
37 ACT-CON																			
38 ACT-PETR																			
39 ACT-CHEM																			
40 ACT-MAN																			
41 ACT-CONS																			
42 ACT-PSRV																			
43 ACT-GSRV																			
44 COM-AGRD																			
45 COM-FOOD																			
46 COM-COND																			
47 COM-PETRD																			
48 COM-CHEMD																			
49 COM-MAND																			
50 COM-CONSD																			
51 COM-PSRVD																			
52 COM-GSRVD																			
53 COM-AGRX																			
54 COM-FOODX																			
55 COM-CONX																			
56 COM-PETRX																			
57 COM-CHEMX																			
58 COM-MANX																			
59 COM-PSRVX																			
60 COM-GSRVX																			
61 COM-AGRM																			
62 COM-FOODM																			
63 COM-CONM																			
64 COM-PETRM																			
65 COM-CHEMM																			
66 COM-MANM																			
67 COM-PSRVM																			
68 COM-GSRVM																			
69 COM-AGRC															31.6	108.7	4.4	0.0	8.0
70 COM-FOODC															6.0	87.1	3.0	0.0	14.7
71 COM-CONC															6.2	11.7	52.6	0.7	3.6
72 COM-PETRC															5.0	5.4	3.7	117.2	9.7
73 COM-CHEMC															17.0	13.1	10.3	2.1	29.1
74 COM-MANC															3.0	11.0	8.2	1.2	6.3
75 COM-CONSC															0.0	1.2	0.8	0.5	0.7
76 COM-PSRVC															14.6	28.6	19.3	3.1	9.9
77 COM-GSRVC															0.3	0.4	0.0	0.0	0.0
78 ROW																			
79 TOTAL	12.8	23.9	39.1	212.9	182.8	159.9	31.6	13.1	5.8	20.8	14.4	7.1	140.4	1.9	625.8	320.6	138.3	133.3	115.6

TABLE 4.4 (Contd.)

	40 ACT-MAN	41 ACT-CONS	42 ACT-PSRV	43 ACT-GSRV	44 COM-AGRD	45 COM-FOOD	46 COM-COND	47 COM-PETRD	48 COM-CHEMD	49 COM-MAND	50 COM-CONSD	51 COM-PSRVD	52 COM-GSRVD	53 COM-AGRX	54 COM-FOODX	55 COM-CONX	56 COM-PETRX	57 COM-CHEMX	58 COM-MANX	59 COM-PSRVX
1 ULBRD																				
2 SLBRD																				
3 SLBRF																				
4 ULBRT																				
5 SLBRT																				
6 CAPITALF																				
7 CAPITALT																				
8 RHSDY																				
9 RHSDC																				
10 UHSDY																				
11 UHSDC																				
12 COMPY																				
13 GOVTY																				
14 GOVTC																				
15 SAV-INV																				
16 I TAX					2.4	42.5	11.8	6.7	7.9	22.0	0.4	14.8	0.5							
17 AL-AGR																				
18 AL-FOOD																				
19 AL-CON																				
20 AL-PETR																				
21 AL-CHEM																				
22 AL-MAN	23.9																			
23 AL-CONS		39.1																		
24 AL-PSRV			212.9																	
25 AL-GSRV				182.8																
26 CAP-AGR																				
27 CAP-FOOD																				
28 CAP-CON																				
29 CAP-PETR																				
30 CAP-CHEM																				
31 CAP-MAN	14.4																			
32 CAP-CONS		7.1																		
33 CAP-PSRV			140.4																	
34 CAP-GSRV				1.9																
35 ACT-AGR					471.9									159.9						
36 ACT-FOOD						284.4									36.2					
37 ACT-CON							120.1									18.2				
38 ACT-PETR								85.4									47.9			
39 ACT-CHEM									83.1									32.5		
40 ACT MAN										129.2									13.7	
41 ACT-CONS											162.3									
42 ACT-PSRV												488.1								168.1
43 ACT GSRV													268.0							
44 COM AGRD																				
45 COM FOOD																				
46 COM-COND																				
47 COM-PETRD																				
48 COM-CHEMD																				
49 COM-MAND																				
50 COM-CONSD																				
51 COM-PSRVD																				
52 COM-GSRVD																				
53 COM-AGRX																				
54 COM-FOODX																				
55 COM-CONX																				
56 COM-PETRX																				
57 COM-CHEMX																				
58 COM-MANX																				
59 COM-PSRVX																				
60 COM-GSRVX																				
61 COM-AGRM																				
62 COM-FOODM																				
63 COM CONM																				
64 COM-PETRM																				
65 COM-CHEMM																				
66 COM-MANM																				
67 COM-PSRVM																				
68 COM-GSRVM																				
69 COM-AGRC	0.1	0.0	0.5	0.5																
70 COM-FOODC	0.5	0.0	45.5	22.4																
71 COM CONC	3.2	5.5	13.8	5.9																
72 COM-PETRC	4.6	21.7	38.8	5.8																
73 COM-CHEMC	11.5	21.6	5.9	3.0																
74 COM-MANC	67.0	29.1	34.5	4.8																
75 COM CONSC	0.7	20.5	6.0	17.9																
76 COM-PSRVC	17.0	17.7	158.4	23.6																
77 COM-GSRVC	0.0	0.0	0.0	0.6																
78 ROW																				
79 TOTAL	142.9	162.3	656.7	269.2	474.3	326.9	131.9	92.1	91.0	151.2	162.7	502.9	268.5	159.9	36.2	18.2	47.9	32.5	13.7	168.1

	60 COM-GSRVX	61 COM-AGRM	62 COM-FOODM	63 COM-CONM	64 COM-PETRM	65 COM-CHEMM	66 COM-MANM	67 COM-PSRVM	68 COM-GSRVM	69 COM-AGRC	70 COM-FOODC	71 COM-CONC	72 COM-PETRC	73 COM-CHEMC	74 COM-MANC	75 COM-CONSC	76 COM-PSRVC	77 COM-GSRVC	78 ROW	79 TOTAL
1 ULBRD																				543.4
2 SLBRD																				357.7
3 SLBRF																			1.8	1.8
4 ULBRT																				543.4
5 SLBRT																				359.5
6 CAPITALF																			12.5	12.5
7 CAPITALT																				407.5
8 RHSDY																			3.4	635.0
9 RHSDC																				538.8
10 UHSDY																			1.9	464.9
11 UHSDC																				374.7
12 COMPY																			8.0	364.4
13 GOVTY																			16.5	363.0
14 GOVTC																				253.8
15 SAV-INV																			51.9	294.2
16 I TAX		0.7	4.0	11.6	19.3	5.4	25.2	0.0	0.3											274.6
17 AL-AGR																				382.2
18 AL-FOOD																				21.8
19 AL-CON																				22.9
20 AL-PETR																				2.7
21 AL-CHEM																				12.8
22 AL-MAN																				23.9
23 AL-CONS																				39.1
24 AL-PSRV																				212.9
25 AL-GSRV																				182.8
26 CAP-AGR																				159.9
27 CAP-FOOD																				31.6
28 CAP-CON																				13.1
29 CAP-PETR																				5.8
30 CAP-CHEM																				20.8
31 CAP-MAN																				14.4
32 CAP-CONS																				7.1
33 CAP-PSRV																				140.4
34 CAP-GSRV																				1.9
35 ACT-AGR																				631.8
36 ACT-FOOD																				320.6
37 ACT-CON																				138.3
38 ACT-PETR																				133.3
39 ACT-CHEM																				115.6
40 ACT MAN																				142.9
41 ACT-CONS																				162.3
42 ACT-PSRV																				656.2
43 ACT GSRV	1.2																			269.2
44 COM AGRD										474.3										474.3
45 COM FOOD											326.9									326.9
46 COM-COND												131.9								131.9
47 COM-PETRD													92.1							92.1
48 COM-CHEMD														91.0						91.0
49 COM-MAND															151.2					151.2
50 COM-CONSD																162.7				162.7
51 COM-PSRVD																	502.9			502.9
52 COM-GSRVD																		268.5		268.5
53 COM-AGRX																			153.9	153.9
54 COM-FOODX																			36.2	36.2
55 COM-CONX																			18.2	18.2
56 COM-PETRX																			47.9	47.9
57 COM-CHEMX																			32.5	32.5
58 COM-MANX																			13.7	13.7
59 COM-PSRVX																			168.1	168.1
60 COM-GSRVX																			1.2	1.2
61 COM-AGRM										12.2										12.2
62 COM-FOODM											21.6									21.6
63 COM CONM												52.7								52.7
64 COM-PETRM													127.5							127.5
65 COM-CHEMM														66.4						66.4
66 COM-MANM															188.0					188.0
67 COM-PSRVM																0.0				0.0
68 COM-GSRVM																	50.2			50.2
69 COM-AGRC																		9.5		496.0
70 COM-FOODC																				348.5
71 COM CONC																				184.6
72 COM-PETRC																				220.1
73 COM-CHEMC																				157.4
74 COM-MANC																				339.2
75 COM CONSC																				162.7
76 COM-PSRVC																				553.1
77 COM-GSRVC																				278.0
78 ROW		11.5	17.6	41.1	108.2	61.0	162.8	50.2	9.2											567.7
79 TOTAL	1.2	12.2	21.6	52.7	127.5	66.4	188.0	50.2	9.5	486.5	348.5	184.6	219.6	157.4	339.2	162.7	553.1	278.0	567.7	

Most of the new changes relate to production activities and the commodity accounts. The income accounts, real consumption and the savings-investment accounts have remained the same. The only new change in the income accounts involve those of factors which have been split into domestic and foreign factors. For example, new accounts showing labour and capital incomes as the sum of earnings from domestic and foreign sources have been created. This change is important for modelling purposes. The distinction between domestic and foreign factors is particularly important because it allows us to concentrate on modelling the domestic factor markets; leaving the foreign factor markets as exogenous.

The intersection of columns 17 to 25 and rows 1 and 2 shows that domestic unskilled and skilled labour combine to form an aggregate labour. The aggregate labour then combine with capital in accounts 35 to 43 to form value added; which combines in the same accounts with intermediate inputs to form gross output. Notice that each type of capital has its own account (row 26 to 34). This is the assumption of sector specificity of capital. This specification accords with the convention that factors or commodities sold at different prices (markets) should have different accounts. The implication of the specificity of capital is that returns to capital may differ among the sectors.

The activity accounts now only represent the technology employed in each sector. The differences in factor intensities shown in Table 4.5 represent differences in sectoral technologies. For example, it is clear that the agricultural sector is highly unskilled

TABLE 4.5

Factor Intensities (Percentage Shares)

	Labour Shares		Total Factor Shares		
	ULBRD	SLBRD	LABOUR	CAPITAL	INTERMEDIATES
AGR	98.1	2.0	61.0	26.0	13.0
FOOD	38.0	62.0	7.0	10.0	83.0
CON	45.0	56.0	17.0	10.0	74.0
PETR	30.0	70.0	2.0	4.0	94.0
CHEM	24.0	76.0	11.0	18.0	71.0
MAN	34.0	66.0	17.0	10.0	73.0
CONS	37.0	63.0	24.0	4.0	72.0
PSRV	40.0	60.0	32.0	21.0	46.0
GSRV	21.0	79.0	68.0	1.0	31.0

labour-intensive. Only 2.0 percent of skilled labour is employed in this sector. The fact that aggregate labour represents 61 percent of total factor shares in the sector underlines the importance of labour in agricultural production. The private and government services also have relatively high labour intensity; but this reflects the high skilled labour intensity in these sectors. For most sectors, except AGR, CHEM and PSRV, capital intensity is relatively low. It is also evident that all the industrial sectors and the construction sector have high intermediate input ratios. The significance of this pattern of the technological structure is that it is through it that trade policy affects production. The effect of trade policy also depends on the relative shares of domestic and import intermediates. Table 4.6 shows that the shares of imported intermediates in the industrial sectors, especially PETR, is high. As it turns out, these sectors are also the most protected. Therefore any trade policy change will have the most significant impact on them.

TABLE 4.6

Intermediate Shares (Percentage)

	Domestic	Imports
AGR	82.2	18.0
FOOD	91.0	9.0
CON	68.0	32.0
PETR	11.0	89.0
CHEM	64.0	36.0
MAN	62.0	38.0
CONS	87.0	13.0
PSRV	88.0	12.0
GSRV	92.0	8.0

The model SAM has more commodity accounts than the other SAMs. Each sector has four commodity accounts; representing consumption of domestic goods, exports, imports and composite goods. The exception is the construction sector which neither exports nor imports any commodity. The activity accounts (row 35 to 43) supply gross output to the domestic (columns 44-52) and export (columns 53-60) markets. The domestic commodity markets pay commodity taxes (row 16), but there are no taxes on exports. However, for policy simulations it is possible to exogenously introduce export taxes. New commodity accounts (61-68) import goods (row 78) and also pay duties (row 16). Domestic and imported commodities are combined to form composite goods in the column accounts 69 to 77 and the row accounts 46-52 and 61-68. Notice that it is from these accounts that consumer goods, capital goods and intermediate inputs are bought. On the other hand, export demands are shown by the intersection of ROW (column 78) and the export commodity accounts (rows 53-60).

The commodity accounts of the SAM can be used to determine the tradability of domestic output. It is common in trade liberalisation models to distinguish between traded and non-traded sectors. As discussed in Chapter Three this dichotomy is commonly associated with the dependent economy models normally used to analyse the expenditure switching effects of policy changes. In these models the prices of traded goods are assumed to be exogenously determined so that their markets are cleared through quantity changes in the domestic economy. This is the most common way of treating exports and imports. On the other hand, prices of non-traded goods are assumed to be determined endogenously; hence their markets are cleared through price changes.

The problem with the former assumption is that the widespread use of import restrictions in LDCs leads to the excess demand for imports being cleared by price changes. Moreover, the sectoral tradability characterised by the dependent economy models imposes a particular model structure. The assertion that excess demand for traded goods is cleared through quantity adjustments rests on the assumption that exports and imports are perfect substitutes for domestic goods. It was argued in Chapter Three that this is not always a realistic assumption; and that the Armington (CET) functions could be used to specify product differentiation between domestic and imported (exported) goods.

The problem of tradability can be dealt with by appealing to the suggestion by Dervis et al (1982, p.240) that the degree of tradability need not be confined to traded and non-traded. The alternative is to distinguish between non-traded, exportable and importable sectors. Under this classification a commodity is non-traded if its share of exports in total production and its share of imports in total domestic supply is small. On the other hand, a commodity is exportable if its share of exports in total production is high and importable if the share of imports in total supply is large.

Table 4.7 shows the shares of domestic supply and imports in total supply and the shares of domestic demand and exports in gross output.

TABLE 4.7

Sectoral Tradability (percentage)

	COMPOSITES		GROSS OUTPUT	
	DOMESTIC	IMPORTS	DOMESTIC	EXPORTS
AGR	97.5	2.5	75.4	24.6
FOOD	93.8	6.2	88.7	11.3
CON	71.5	28.5	86.8	13.2
PETR	41.9	58.1	64.1	35.9
CHEM	57.8	42.2	71.9	28.1
MAN	44.6	55.4	90.4	9.6
CONS	100.00	0.00	100.00	0.00
PSRV	90.9	9.1	74.4	25.6
GSRV	96.6	3.4	99.6	0.4

It is clear from the table that the construction and government services are non-tradables. Private services sector (with 26 percent of its gross output exported) does not come out as a non-tradable. The high export share of this sector is explained by the fact that the exports include tourism which is a major foreign exchange earner in Kenya. Manufacturing is an importable sector while petroleum and chemicals are tradable sectors with a bias for the domestic market. The foods and consumer goods sectors have low import and export shares. They therefore behave as non-tradables although this may not be particularly true for consumer goods sector whose imports make up 29 percent of total supplies. The agricultural sector with 25 percent of its gross output exported would appear to be tradables. However, this tradability is reduced by the fact that imports to this sector only account for 2.5 percent of the total supply of agricultural goods. This result arises from the fact that the agricultural sector is dominated by the subsistence production. A more appropriate degree of tradability of this sector could be obtained by separating cash crops from subsistence crops. But the SAM does not allow for this differentation.

The disaggregation of the 19x19 data SAM to a 78x78 model SAM has profound implications. In the model SAM the interaction among the various agents (accounts) are now much simpler and direct. This allows for a more explicit modelling of agents behaviour than would have been possible with the data SAM. The next section formalises the model implied by what we have called the model SAM. This is done using the TV-approach to modelling.

4.3 The Model

4.31 Modelling : A TV-Approach

The TV-approach to modelling involves specifying the functional forms of the equations which determine the cell values of the model SAM. In the usual way, this amounts to specifying agents behaviour and the technological constraints and therefore an economy wide general equilibrium model.

The functional form of the cell values can be specified in a generalised way as:[4/]

$$t_{ij} = t_{ij}(p, y; \theta, \Omega) \tag{4.2}$$

where p and y are vectors of endogenous prices and incomes (expenditures) respectively; θ are exogenous variables and parameters which can be calibrated from the SAM and Ω are parameters that cannot be calibrated from the SAM and therefore have to be exogenously provided. What is noteworthy of (4.2) is that the independent variables are expressed in prices and values only.[5/] This appears rather unusual because in most models quantities are explicitly specified. The TV-approach specification however does not lead to any loss of information because quantities are nested in the system. For example, the values of y can be expressed as

$$y_i = p_i q_i$$

hence (4.3)

$$\frac{y_i}{p_i} = q_i$$

This shows that from the values of the SAM data, quantities can be obtained through (4.3), as the real value solutions.

The advantage of this approach is that by pushing quantities to the background, it allows for modelling in values. This property underlies the advantage of using the TV-approach to model with SAM-based data. Indeed it is this modelling with prices and values which distinguishes the TV-approach from conventional CGE models which model with prices and quantities.

The cell quantities can be expressed in a similar fashion. If p_{ij} and q_{ij} are the price and quantity relations in each cell then cell value can be expressed as

$$t_{ij} = p_{ij}q_{ij} = p_i q_{ij} \tag{4.4}$$

Hence the cell quantity is simply obtained as $t_{ij}/p_i = q_{ij}$; where $p_i = p_{ij}$. As noted by Drud, Grais and Pyatt (1986) the restriction that $p_i = p_{ij}$ in (4.4) is based on the assumption that commodities or factors sold in the same market must command the same price. This also formalises the assumption that differentiated products or sector-specific factors must be assigned different accounts in the SAM.

Modelling of agents' behaviour using the SAM data is done through the column accounts. For example, activity accounts are used to model producer behaviour and the consumption accounts are used to model consumer behaviour. Other accounts are used to model income distribution and transfers, commodity supplies and demands, taxes and so on. In what follows we develop the model to be used for empirical analysis. Our main aim is to model agents behaviour, the determination and distribution of the national product.

4.32 Technology

The model SAM (Table 4.4) shows that the underlying technology of the model is basically a two-level production process whereby aggregate labour and capital combine to form value added in the first level; and in the second level value added and intermediates combine to form gross output. This aggregation takes place in the columns of the activity accounts.

Total labour (L_j) employed in each sector j is an aggregation of skilled (SL_j) and unskilled (UL_j) labour. These labour types are aggregated using a CES function of the form

$$L_j = \beta_j [\delta_j SL_j^{-\rho_j} + (1 - \delta_j)\, UL_j^{-\rho_j}]^{\frac{1}{-\rho_j}} \qquad (4.5)$$

where β_j , δ_j are efficiency and distribution parameters and ρ_j is a parameter which determines the elasticity of substitution as $\sigma_j = \frac{1}{1 + \rho_j}$. The derived demand for each labour category can be obtained from (4.5) under the usual cost minimisation problem. If w_j , w_{sj} , and w_{uj} are wages for aggregate, skilled and unskilled labour, respectively, and assuming no efficiency gains; then the first order conditions for cost minimisation gives the demand functions for the two labour categories as:

$$SL_j = \delta_j^{\sigma_j} \left(\frac{w_{sj}}{w_j}\right)^{\frac{1}{\sigma_j}} L_j \qquad (4.6)$$

$$UL_j = (1 - \delta_j)^{\sigma_j} \left(\frac{w_{uj}}{w_j}\right)^{\frac{1}{\sigma_j}} L_j \tag{4.7}$$

Note that (4.6) and (4.7) are specified in prices and quantities. We use (4.3) and (4.4) to convert these two equations into TV-form. Let $L_{ij} = t_{ij}/w_i$ and $L_j = y_j/w_j$ where i is now an index of labour type so that w_i is the wage of labour type i in each sector. Then substituting for SL_j, UL_j and L_j, and after some manipulations, (4.6) and (4.7) can be expressed as

$$t_{ij} = a^o_{ij} \left(\frac{w_i}{w_j}\right)^{1-\sigma_j} y_j \tag{4.8}$$

showing the demand for each labour type in each sector in value form. Note that y_j is the column sum, in this case the total labour costs of sector j. The parameter a^o_{ij} is the base value share of each factor cost; derived as

$$a^o_{ij} = \frac{t_{ij}}{y_j} \tag{4.9}$$

While the price of each labour category is obtained from marginal conditions, it can be shown using (4.8) that the returns to aggregate labour is a CES aggregation of the wage payments of the various sectors. Notice that summing over i in (4.8) implies

$$y_j = \sum_i t_{ij} = \sum_i [a^o_{ij} (\frac{w_i}{w_j})^{1-\sigma_j}] \, y_j \tag{4.10}$$

Hence

$$w_j = (\sum_i a^o_{ij} \, w_{ij}^{1-\sigma_j})^{\frac{1}{1 - \sigma_i}} \tag{4.11}$$

This confirms that the wage in sector j is a CES aggregation of the wages of the two labour types. Since a sector's wage is weighted by the labour shares in the total wage bill, it should be directly related to labour type intensively used in that sector. This means for example that a sector which employs a high proportion of unskilled labour should have an aggregate wage close to that of unskilled labour.

In the first-level of the production process the activity accounts combine aggregate labour and capital in CES form to produce net output (value added). The specification of the cell value of this output is of the form

$$t_{ij} = a^o_{ij} (p_i/p_j)^{1-\sigma_j} \, y_j \tag{4.12}$$

where p_i is the price of aggregate labour or capital and p_j is the net (value added) price. The net price is a CES aggregation of input prices p_i in the form of (4.11); that is

$$p_j = \left(\sum_i a^o_{ij} p_i^{1-\sigma_j}\right)^{\frac{1}{1-\sigma_j}} \tag{4.13}$$

When modelling the formation of net output assumptions about factor mobility are important. Models aimed at analysing long-run economic adjustments generally assume perfect factor mobility between sectors. However, for short-run models such an assumption would be unrealistic. In the short-run, capital once installed, cannot be easily moved from one sector to another. Since our model is mainly concerned with short-run effects of policy changes we assume mobile labour and sector specific capital.

Some studies, for example Roe and Pal (1986), introduce land as a factor of production. Given that the SAM does not break down capital into land and other forms of capital Roe and Pal assume that all the capital attributable to the agricultural sector is land. With our assumption of sector-specific capital, substituting land for capital does not change the interpretation of the generation of agricultural output; hence we see no advantage in specifying land as a factor of production model. Gunning (1979) uses land by farm size as a factor of production. Again, our SAM data only maps farm size to households and not to activities and therefore cannot be used as a factor.

Within the first-level of production intermediate inputs also combine according to Leontief technology. The assumption is that these inputs are complementary. Leontief technology implies a special case of (4.12) where $\sigma_j = 0$. Hence

$$t_{ij} = a^o_{ij}(p_i/p_j)\ y_j \tag{4.14}$$

where p_i is the price of intermediate input i and p_j is the composite price determined as a CES aggregation of p_i .

In the second-level of production, aggregate intermediates combine with value added according to Leontief technology to form gross output. This is modelled in the same way as (4.14) where p_i now are net prices; and p_j are the gross prices, determined as a CES aggregation of p_i .

4.33 Demand and Supply of Commodities

In Chapter Three, the formation of composite goods from domestic and imported goods and the transformation of gross output into domestic goods and exports was discussed. The Armington functions were used to model the formation of the composite goods; while CET functions were used to model the transformation of gross output. Below we discuss the modelling of the cell equations of these functions.

The cell values of the composite goods are specified, by converting (3.3) and (3.4) into TV-form as

$$t_{ij} = a^{o}_{ij}\left(\frac{p_i}{p_j}\right)^{1-\sigma_j} y_j \tag{4.15}$$

where p_i is the domestic or import price and p_j is the composite price of commodity j formed as a CES aggregation of domestic and import prices. The parameter σ_j, as defined before, is the elasticity of substitution between domestic and imported goods.

The cell equations for the CET functions are specified by converting (3.12) into TV-form as

$$t_{ij} = a^{o}_{ij}\left(\frac{p_i}{p_j}\right)^{\psi_i - 1} y_i \tag{4.16}$$

where p_i are domestic or export prices and p_j are the average sales price. The parameter ψ_i is the elasticity of transformation and y_i is the gross output.

In specifying the trade functions we follow the small country assumption on the import side; and supply is assumed to be perfectly elastic so that all the desired imports can be obtained at the going world price. Payments (import supply) to ROW for imports is therefore specified as

$$t_{ij} = a^{o}_{ij}\ \overline{WP}_{ij}{*}ER(y_j/p_j) \tag{4.17}$$

where y_j/p_j are import quantities based on import prices inclusive of duties and a^o_{ij} is a factor which converts the import quantities to those based on prices exclusive of duties. In our model the parameter a^o_{ij} is calibrated from the base SAM.

The introduction of product differentiation to the export side as shown earlier implies less than infinite elastic demand for exports. This leads the specification of export demand functions as

$$X_{ij} = a^o_{ij}\left(\frac{\overline{WP}_j}{PE_i}\right)^{\eta_{ij}} \tag{4.18}$$

where X_{ij} is the quantity of exports, a^o_{ij} is base quantity of exports, and η_{ij} is the price of elasticity of export demand; while WP_i and PE_i are defined as before.

As noted by Dervis et al (1982), while export prices (and hence terms of trade) are no longer fixed, (4.18) does not imply that a country can affect the world price. All it means is that policies that affect the foreign currency price of exports can affect the demand. For example, policies that aim to make a country's exports competitive in world markets such as subsidies or devaluations by lowering PE_i can stimulate export demand.

The model SAM shows that gross output is valued at producer prices. However, the commodity accounts pay indirect taxes when they buy these goods. Indirect tax revenue is modelled as a percentage of commodities valued at market prices. For instance, let τ_j be the indirect tax rate and y_j be the market value of commodity j then

$$t_{ij} = \left(\frac{\tau_j}{(1 + \tau_j)}\right) y_j \tag{4.19}$$

is the cell value of tax revenues. Hence, τ_j can be calibrated from the base values of y_j and t_{ij} .

Alternatively, tax revenues can be viewed as a mark-up on the pre-tax value of gross output. In this the value of commodities can be expressed as

$$y_j = (1 + \tau_j)\, y_j^* \tag{4.20}$$

where y_j^* is the gross output value of commodity j . This equation shows that commodity y_j is inclusive of indirect tax $\tau_j y_j^*$, and therefore is valued at market prices.

The formation of composite goods determines the total supply of each commodity to the economy. These commodities are used up as final consumption by households and the government, as intermediates by the activities, and for capital formation. Hence

$$XS_i = C_i + G_i + I_i + K_i \tag{4.21}$$

where XS_i are total supplies of sector i ; C_i are household household consumption; G_i are government consumption; I_i are intermdiate demands; and K_i are investment demand by sector of origin. Intermediate demands are specified by (4.14); while investment demands are modelled in fixed shares as:

$$t_{ij} = c_{ij}Y_j \tag{4.22}$$

where c_{ij} are the shares of sector i in total investments. This defines investment by sector of origin.

In our model the government consumes only one commodity, government services. It is usually assumed that this consumption is fixed in the budget, either in real or nominal terms. Given the severe budget constraints normally faced by developing countries it would be unrealistic to model government consumption in real terms. We therefore model government consumption in nominal terms. This is specified in TV-form as:

$$t_{ij} = t^{o}_{ij} \tag{4.23}$$

where t^{o}_{ij} is the base quantity of government consumption. The real values, estimated as $Y_{ij} = \frac{t_{ij}}{p_i}$, will change with change in the government consumer price index. This specification therefore allows the government to use the budget as a policy instrument by manipulating p_i or t_{ij} .

Household consumption is specified using the linear expenditure system (LES). The utility function underlying this system is a Stone-Geary type. The consumer problem can be stated as follows:

$$\max U_h = \sum_{i=1}^{n} \beta_{ih} \log(C_{ih} - \alpha_{ih}) \tag{4.24}$$

$$1 < \beta_i < 0 \ , \ \Sigma\beta_i = 1$$

$$\text{s.t.} \ \sum_{i=1}^{n} P_i C_{ih} = Y_h$$

where C_{ih} is the consumption of commodity i by household h, Y_h is the income of household h and β_i and α_i are the parameters of the utility function. From (4.24) demand functions are obtained (suppressing index h) as:

$$C_i = \alpha_i + \frac{\beta_i}{P_i} (Y - \sum_k P_k \alpha_k)$$

or

$$P_i C_i = P_i \alpha_i + \beta_i (Y - \sum_k P_k \alpha_k) \tag{4.25}$$

which shows that the total expenditure on the i_{th} commodity is made up of the "subsistence" expenditure $(p_i \alpha_i)$ and "supernumerary" expenditure $(Y - \sum_k P_k \alpha_k)$. The parameters β_i, the marginal budget shares, show how consumers allocate their discretionary expenditures.

It is also evident from (4.25) that total expenditure is a linear function of prices and income.

The structure of LES equations, mainly as a result of their foundation on additive utility function, generate rather unusual results. Differentiating (4.25) with respect to income (expenditures) and prices gives:

$$\varepsilon_{iy} = \frac{\beta_i Y}{P_i C_i} > 0 \tag{4.26}$$

$$\varepsilon_{ii} = -\varepsilon_{iy}\left[\frac{P_i \gamma_i}{Y} + \left(\frac{Y - \sum_k P_k \gamma_k}{Y}\right)\right] < 0 \tag{4.27}$$

and

$$\varepsilon_{ij} = -\varepsilon_{iy}\left[\frac{P_k \gamma_k}{Y}\right] \leqslant 0 \tag{4.28}$$

where ε_{iy} , ε_{ii} , and ε_{ij} are income, own price, and cross-price elasticities, respectively. Equation (4.26) shows that there are no inferior goods, while (4.27) and (4.28) show that all goods are substitutes for each other. However, this substitutability between goods arise mainly from the additive nature of the utility functions underlying LES. The absence of complementarity between goods is also a result of the restrictiveness of the Stone-Geary utility function. This property implies that the marginal utility of each good is independent of other goods.

4.34 Income Generation and Distribution

Having modelled producer and consumer behaviour in the previous sub-sections we now specify sources of income and how they are redistributed among the institutions and ROW. The institutions are defined here as the households, companies and government income accounts. The determination of factorial and disposable income, savings and tax payments are also modelled. The model takes into account the fact that factorial and institutional incomes are obtained from two different sources; domestic and the ROW.

Payments to factor type f by sector j are specified as

$$t_{fj} = a^{o}_{fj} y_j \tag{4.29}$$

This shows that the payment to the f_{th} factor is a fixed share of total factor payments in the j_{th} sector. The total income of the f_{th} factor from domestic and foreign sources is therefore specified as

$$y_f = \sum_{f}^{n} a^{o}_{fj} y_j + t^{o}_{ij} \, ER \tag{4.30}$$

where t^{o}_{ij} ER are the exogenous payments from abroad converted to domestic currency values using exchange rate ER. Domestic payments are now total payments to the factor from all the sectors. The exogeneity of foreign payments reflects the fact that we are not concerned with modelling foreign factor markets.

The formation of institutional income can be modelled as

$$Y_h = \sum_f a_{hf} y_f + \sum_h a_{hh} y_h + t^o_{ij}\ ER \tag{4.31}$$

In our SAM (4.31) determines only incomes of households and companies. This equation shows that the h_{th} institution's income is made up of receipts from factors, income transfers from other institutions $(\sum_h a_{hh} y_h)$ and the rest of the world $(t^o_{ij}\ ER)$. Institutions receive a fixed proportion of factor income, reflecting their factor shares. Notice that as before the transfers from ROW are exogenously fixed in foreign currency values.

Household disposable income is specified as

$$y^d_h = (1 - t_h - s_h - \sum_h a_{hh})\ y_h \tag{4.32}$$

where t_h and s_h are tax and savings rates, respectively. This equation shows the disposable income as gross income net of direct taxes, savings and transfers. The transfers include those to the rest of the world which are modeled in fixed shares. The disposable income is allocated to the institutions' consumption account in the SAM.

The distribution of company incomes differ from those of the households in that companies do not consume commodities. This means that company incomes are exhausted by direct taxes, savings and transfers. Hence

$$y_h(1 - t_h - s_h - \sum_h a_{hh}) = 0 \tag{4.33}$$

The treatment of government income is a lot more elaborate than those of households and companies. This can be seen from the following equation.

$$y_h = \sum_h a_{hh} y_h + \sum_f a_{hf} y_h + \sum_h t_h y_h + \sum_j t_j X_j + \sum_j t_j M_j \, ER$$
$$+ t^o_{ij} + t^o_{ij} \, ER \tag{4.34}$$

which shows that government revenues (y_h) are made up of transfers from institutions, fixed shares of factor incomes, direct taxes on institutions' incomes, and indirect taxes on the domestic goods (X_j) and on imported goods (M_j). It also includes exogenous transfers (t^o_{ij}) from government and ROW. As discussed before Government consumption is fixed in the budget.

In our model, given government income and consumption, government savings are specified as a residual. In TV-form this specification has no equation.

The income account of ROW is modelled as

$$y_r = \sum_f a_{rf} y_f + \sum_h a_{rh} y_h + \sum_j \overline{wp}_j M_j ER + t^o_{ij} \tag{4.35}$$

showing payments to the rest of the world as transfers of factor and institutional incomes in fixed shares, payments for imports, and exogenous government transfers.

On the other hand, receipts from ROW are in the form of export earnings and exogenous transfers to factors and institutions. Hence

$$y_r^* = \sum_j PE_j ER + t_{ij}^o \ ER \qquad (4.36)$$

shows total payments from abroad to Kenya.

4.35 Balance of Payments, Savings and Investments

Having established the payments to and receipts from ROW, the balance of payments (foreign savings) is simply specified as their difference. Hence

$$FS = y_r - y_r^* \qquad (4.37)$$

The way the current account is modelled plays a crucial role in the determination of the closure of the economic system. For example, if the country is not constrained in foreign capital markets the account can be specified as a residual. In this case foreign savings equilibrate the current account. If on the other hand the supply of foreign capital is inelastic then foreign savings is fixed.

If foreign savings clear the external balance then (4.37) is not specified; otherwise it is specified as $FS = t^{o}_{ij}ER$.

Total savings can now be specified as

$$S = \sum_i S_h Y_h + t^{o}_{ij}ER \tag{4.38}$$

showing total savings as being made up of institutional savings and fixed exogenous transfers from ROW. Foreign savings are equal to the balance of payments in domestic currency.

With total savings determined, they have to be equated with total investments. Hence

$$S = I \tag{4.39}$$

where total investments (I) are determined from (4.22) as

$$I = \sum_i t_{ij} = \Sigma c_{ij} Y_j \tag{4.40}$$

The equalisation of S and I determines the macroeconomic closure.

For example, with fixed I and exogenously determined foreign savings, the domestic savings will have to adjust to meet the desired investment demand. This is the so-called investments driven model. However, if investments is endogenous then it adjusts to available savings and we have a savings driven model.

4.4 Summary

In this Chapter we have introduced the data that will be used in the empirical analysis. The reasons why the data were not useful for modelling purposes in the original form has been discussed. This was followed by a step-by-step review of the modifications which have been made to transform the original SAM into a model SAM. It should be stressed that the model SAM (Table 4.4) is so named because it contains most of the information needed to model the Kenyan economy. This unique characteristic is reflected by the fact that the model developed in Section 4.3 is actually a formalisation of how the values of each cell and account in the SAM are determined. The functional forms of the cell and account equations are shown in the specification table in the Appendix. It is evident from this table that each cell value of the SAM is in effect superimposed by an equation showing how it is determined.

Modelling through the cells and accounts of the SAM means that for the system to be determined each cell and account must be balanced. The high dimensionality of the SAM however makes it difficult to establish the determinancy of the model in the usual way of counting variables and equations. For example, with a 78 by 78 SAM, the number of cell elements (although many will take zero values) and hence variables and equations will be so high as to make counting a tedious process. Drud and Kendrick (1986, Chapter 9) provides a simpler method of counting equations and variables. In this method degrees of freedom are assigned to the cell specifications; where the degrees of freedom equal the number of variables less the number of equations. A cell is therefore balanced if it has zero degrees of freedom and has more or less variables than equations if it has positive or negative degrees of freedom. The determinancy of the system is therefore established by counting the degrees of freedom associated with the specification of each cell and account. An alternative method is provided by Drud et al (1986).

The program we use for our simulations (HERCULES) provides a summary table showing the number of variables and equations of the model. In our base model there are 792 equations and variables. However, it should be noted that a change in closure rules and/or experiments changes the number of equations and variables in the model.

CHAPTER FIVE

MODEL PARAMETARISATION, CLOSURE RULES AND BASE SOLUTION

5.1 Introduction

Chapter 4 introduced the data and the model we shall use for policy analysis. A SAM which was otherwise not useful for policy purposes was transformed into a model SAM. A model underlying the SAM was then specified. The aim of this chapter is to parametarise the specified model before it can be used to simulate policy changes. The parameterisation of the model ensures the model can reproduce the base year data, the so-called "benchmark" equilibrium, as its solution. This is achieved through "calibration"; a process Mansur and Whalley (1984 p.86) defines as "the ability of the model to replicate base year data as a model solution". This ability of the model to replicate the benchmark equilibrium data has two significant implications. Firstly, it confirms the consistency of the data set; and secondly, it establishes that at least one solution to the system exists.

In the context of the CGE framework the consistency of the data implies zero excess demands in all the markets. It also implies that incomes and expenditures satisfy the budget constraints of the agents in the economy, and that firms earn normal profits. Although calibration confirms the existence of an equilibrium solution to the model it does not guarantee that the solution is unique. However, there are no known cases of non uniqueness in the literature, but this is not enough to rule out the existence of multiple equilibria. In the absence of alternative methods of determining uniqueness we assume that the solutions obtained from our simulations are unique. Another weakness related to the use of calibration is that because of its deterministic nature the robustness of the model results cannot be statistically tested. Lau (1984) suggests that this problem can be dealt with by stochastic estimation of CGE models. The problem with this argument is that it fails to appreciate that it is precisely because of the difficulty of applying econometric estimation to CGE models, particularly because of their high dimentionality and the poor quality of available data, that calibration is used.

In this chapter no attempt is made to provide a detailed analysis of the issues associated with the numerical specification and solution of CGE models. These issues are given a thorough treatment in Shoven and Whalley (1984), Mansur and Whalley (1984) and Manne (1985). The parameterisation of the model is done in the next section and the resulting base solution is given in section 5.3. In section 5.4 the sensitivity of the models results to parameter (elasticities) changes is analysed. The last section of the chapter discusses the macroclosures of the model. Some experiments are carried out to determine the implication of different closure rules for the model results.

5.2 Model Parameterisation

To calibrate the model requires estimates of several parameters. These include the share and scale parameters of the production functions, the share parameters of the income distribution and consumption systems, and elasticities. However, where the base

SAM is established as a solution to the model some of these parameters can be endogenously determined. For example, β_j and δ_j can be determined from (4.5) and their first order conditions (4.6) and (4.7). The variables L_j , SL_j, UL_j, w_j and w_{ij} can also be parameters uniquely determined from base year data; and with these parameters, σ_j can be obtained from (4.6) or (4.7) as:

$$\delta_j = \left(\frac{w_{ij}}{w_j}\right) \left(\frac{SL_j}{L_j}\right)^{\frac{1}{\sigma_j}} \tag{5.1}$$

Since prices are set to unity in the base solution (5.1) becomes

$$\delta_j = \left(\frac{SL_i}{L_j}\right)^{\frac{1}{\sigma_j}} \tag{5.2}$$

Equation (5.2) can be converted to value-form by setting $SL_j = t_{ij}/w_i$ and $L_j = y_j/w_j$ to obtain

$$\delta_j = a^o_{ij} = \left(\frac{t^o_{ij}}{y^o_j}\right)^{\frac{1}{\sigma_j}} \tag{5.3}$$

Where t^o_{ij} and y^o_j are base values

With the value of δ_j determined, β_j is obtained from (4.5) as

$$\beta_j = \frac{L_j}{[\delta_j \, SL_j^{-\rho_j} + (1 - \delta_j)UL_j^{-\rho_j}]^{\frac{1}{\rho_j}}} \tag{5.4}$$

Where SL_j, UL_j, and L_j are base quantities of labour.

Notice that δ_j can be obtained from values only while β_j are obtainable from quantities. The same procedure is also used to estimate the share and distribution parameter values for the Armington and CET functions. Notice also that since (5.3) and (5.4) are derived from a CES function and given the base prices and quantities, δ_j and β_j can be determined only after σ_j have been exogeneously supplied.1/ This problem does not arise in the cases where Leontief or Cobb-Douglas functions are used because their σ_j are zero and unity, respectively, hence their parameters are uniquely determined from base data. The elasticities required for calibration include those for production and Armington functions, export demand elasticities, and the elasticities for CET functions.

As in other studies we rely on literature search for these elasticities. The problems associated with the use of elasticities derived in this manner have been widely discussed.2/

Among the most serious shortcomings of extraneously obtained elasticities is that they are in most cases from different sources. This means that they are often estimates for different commodities than those being considered, or are based on economies or periods different from those being investigated. Moreover, they may not exist at all in which case "questimates" are used. The robustness of these parameters is tested through "sensitivity" analysis.

Table 5.1 contains the elasticities we use for calibration and sensitivity analysis. They are the elasticities of substitution between unskilled and skilled labour (ε_{LL}) , aggregate labour and and capital (ε_{Lk}) , domestic and imported goods (ε_{dm}) , export demand elasticities (ε_{x}) , and the constant elasticities of transformation (ε_{t}) . Each type of elasticity has been divided into low, medium and high values to establish the sensitivity of the model results. Except for (ε_{Lk}) the estimates of the rest of the parameters using Kenya data could not be be found. Most of the elasticities in Table 5.1 therefore are elasticities from studies of other economies.

Estimates of the elasticities of substitution between labour categories are sparse and fraught with inconsistencies. Estimates for developed countries cited in Dixon et al. (1982) show that they range from 0.0 - 1.0. Adelman and Robinson (1978) and Dervis et al. (1982) assume unitary elasticities for Korea and Turkey, respectively. Taylor et al. (1980) use elasticities ranging from 4.0 to 7.0 for their Brazillian study; while Bowles (1970) argue that it would be appropriate to assume infinite elasticities of substitution among various labour categories. For short-run LDC models such an assumption, especially where labor types are classified by skill, would be difficult to justify. The elasticity values we have used for sensitivity analysis are from Taylor et al. (1980). The high values recorded in Table 5.1 are half the original values. In simulating policy experiments we assume low substitutability between skilled and unskilled labour; and hence use the low elasticity values.

There is little disagreement in the literature about the elasticity of substitution between capital and labour. Dixon et al. (1982) suggest the values of these elasticities obtained from time series estimates are about 0.5 while those obtained from cross-section estimates lie at about 1.0. They also argue that the time series estimates are more appropriate in analysing short-run issues. Most studies of Kenya have used values of σ_{lk} between 0.5 and 0.75. Bevan et al. (1987) estimated σ_{lk} for the manufacturing sector of 0.5 and imposes it on all other sectors. Blomqvist and McMahon (1986) use σ_{lk} of 0.75 for the two sectors (manufacturing and agriculture) in their study and McMahon (1984) uses σ_{lk} which range from 0.5 to 0.75 for several sectors. Maitha (1973) estimates σ_{lk} for various Kenyan manufacturing sectors using cross-section data. His results range from 0.5 to 1.00 which is consistent with the observations by Dixon et al. We use Maitha's estimates in this study; with the original estimates treated as the medium case in Table 5.1. However, it should be noted that Maitha does not estimate the elasticities for the construction sector, private and government sectors and so they have been obtained from Dervis et al. (1982).

There are no estimates of trade elasticities for Kenya. McMahon (1984) uses export demand elasticities ranging from 2.0 - 6.0 and Armington elasticities ranging from 0.14 - 1.0. We obtain these elasticities from Dervis et al. (1982) which we record as the low and

TABLE 5.1

Elasticities Used for Sensitivity Analysis*

	ε_{LL} [1]			ε_{Lk} [2]			ε_{dm} [3]			ε_{x} [4]			F_t [5]		
	L	M	H[a]	L	M[b]	H	L[c]	M	H[c]	L[c]	M	H[c]	L	M	H[c]
AGR	0.88	1.75	3.50	0.38	0.75	1.50	2.0	4.0	6.0	1.0	1.5	2.0	0.38	0.75	1.5
FOOD	0.69	1.38	2.85	0.38	0.75	1.50	0.75	1.5	2.25	2.0	3.0	4.0	0.38	0.75	1.5
CON	0.69	1.38	2.85	0.38	0.75	1.50	0.75	1.5	2.25	3.0	4.5	6.0	0.38	0.75	1.5
PETR	0.63	1.25	2.50	0.38	0.75	1.50	0.33	0.66	1.0	3.0	4.5	6.0	0.13	0.25	0.5
CHEM	0.50	1.0	2.0	0.25	0.50	1.0	0.33	0.66	1.0	3.0	4.5	6.0	0.13	0.25	0.5
MAN	0.56	1.13	2.25	0.35	0.70	1.4	0.33	0.66	1.0	3.0	4.5	6.0	0.13	0.25	0.5
CONS	0.63	1.25	2.5	0.25	0.50	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PSRV	0.69	1.38	2.85	0.30	0.60	1.2	0.25	0.50	0.75	2.0	3.0	4.0	0.13	0.25	0.5
GSRV	0.69	1.38	2.85	0.25	0.50	1.0	0.25	0.50	0.75	0.5	0.75	1.0	0.13	0.25	0.5

*: Because of differences in aggregation the parameter-sector mappings may not correspond to those in the original sources.

Source:
(a) Taylor et al (1980), p. 197, Table 8.9

(b) Maitha (1973), p. 47, Table 2.

(c) Dervis et al (1982), p. 263, Table 8.2.

(d) Grais et al (1986), p. 75, Table 5.

Note:
(1) Low and medium values are $\frac{1}{4}$ and $\frac{1}{2}$ the high values, respectively.

(2) Low and high values are $\frac{1}{2}$ and twice the original values, respectively.

(3) Medium values are $\frac{1}{2}$ the original high values.

(4) Medium values are $\frac{3}{4}$ the original high values.

(5) Low and medium values are $\frac{1}{4}$ and $\frac{1}{2}$ the original values, respectively.

high values in Table 5.1. Estimates of elasticities for the CET functions are a recent phenomenon. Powell and Gruen (1968) and Dixon et al. (1982) have estimated these elasticities for some commodities in the Australian agricultural sector. We obtain these elasticities from Grais, de Melo, and Urata (1986); the same elasticities are also used in Condon, Robinson and Urata (1985).

The other parameters required before the model can be solved are those of the consumer demand system (LES).[3/] The elasticities of these functions are derived using equations (4.26) - (4.28). While the marginal budget shares (β_i) can be calibrated from base SAM data given the minimum level of consumption of commodity i (α_i); α_i cannot be calibrated from the base SAM. Both parameters are therefore obtained through indirect estimation. To do this, first note that (4.6) can be written as

$$\beta_i = \varepsilon_{iy} V_i \tag{5.5}$$

where $V_i = p_i C_i / Y$ is the average budget share of the ith commodity in the consumer's total expenditure. Hence, given ε_{iy} and v_i, β_i can be easily computed from (5.5). The values for v_i are obtained from household budget surveys reported in Kenya (1988). Expenditure elasticities are obtained from Massell and Heyer (1969), Gunning (1979), and Okunade (1985). The original v_i and ε_{iy} were hand-adjusted to satisfy the adding up condition $(\sum_i v_i = 1)$ and the Engel aggregation condition $(\sum_i v_i \varepsilon_{iy} = 1)$.

To estimate α_i we still need to derive total committed expenditure. To do this we assume that the share of committed expenditure in total consumption is 75 per cent and 70 per cent for rural and urban households, respectively. This amounts to assuming a Frisch parameter value of -4.0 and -3.3 for the two households, respectively. These values are in line with those obtained from various cross country studies by Lluch, Powell, and Williams (1977).

With the given base prices and incomes and the estimated values of β_i and $\sum_k p_k \alpha_k$; α_i can now be computed from (4.25). For instance α_i for urban households is calculated as

$$\alpha_{iu} = C_{iu} - \beta_{iu} \left[\frac{(1 - 0.70)Y_u}{p_i}\right] \tag{5.6}$$

Hence, given that all prices are set to unity in the base case (5.6) becomes

$$\alpha_{iu} = c_{iu} - \beta_{iu} (1 - 0.70)Y_u \tag{5.7}$$

The estimated LES parameters and the associated elasticities are shown in Table 5.2. Both the expenditure and own-price elasticities are within the expected ranges. For both households ε_{iy} are greater than unity for luxury goods (manufactured) and less than unity for necessities (foods). Notice that government services is a necessity for rural households, but a luxury for the urban households.

This result reflects the fact that urban households consume a large share of GSRV so that ε_{iy} was inflated when being hand adjusted to satisfy the Engel aggregation condition. This also explains the high ε_{iy} for agricultural goods for both households. Notice also that the own-price elasticities are close to half of the income elasticities for all commodities implying a constant ratio

TABLE 5.2

Parameters of the Linear Expenditure System (LES)

	Rural Households				Urban Households			
	ε_{iy}	ε_{ii}	β_i	V_i^*	ε_{iy}	ε_{ii}	β_i	V_i^*
AGRC	1.168	-0.771	0.570	0.488	1.003	-0.541	0.080	0.080
FOODC	0.509	-0.283	0.100	0.196	0.722	-0.438	0.120	0.166
CONC	1.422	-0.612	0.100	0.070	1.784	-0.912	0.180	0.101
PETRC	-	-	-	-	1.922	-0.962	0.020	0.010
CHEMC	0.966	-0.411	0.040	0.041	0.871	-0.464	0.05	0.006
MANC	1.456	-0.599	0.040	0.027	1.125	-0.606	0.10	0.089
CONSC	-	-	-	-	-	-	-	-
PSRVC	0.917	-0.455	0.140	0.153	0.875	-0.622	0.400	0.457
GSRVC	0.634	-0.261	0.01	0.016	1.301	-0.668	0.050	0.038

*Source: Kenya Economic Survey (1988), Table 3.3

between the two elasticities. This is a result of the additive nature of the utility function underlying LES.

5.3 Calibration

Having specified all the parameters of the model in the previous section the model is then calibrated. This is done using HERCULES software developed by Drud and Kendrick (1986); a sub-system of the GAMS package of Kendrick and Meeraus (1986). HERCULES is a Newton type algorithm and was developed to implement TV-Approach type models.

Table 5.3 shows the base solution of the model; with base values given by YBASE. From the GDP summary part of the Table we can see that the base values of GDP at factors cost, indirect taxes, exports, imports and balance of trade (resource gap) are all replicated. Given that base prices (PSOL) are set to unity, the quantity (QSOL) and incomes (YSOL) solutions are equal to YBASE. As discussed before, the quantity solutions of the model are derived by deflating YSOL by PSOL. Such solutions (QSOL) are also real values and hence are compared with YBASE to determine changes in real values resulting from a policy change. For example, the changes in the real values can be used to infer the welfare gains or losses and/or the change in the structure of the economy. Some of these issues are further discussed in the appendix.

Notice that some accounts have no price and quantity solutions. These are mainly the income transfer accounts for non market factors, institutions and indirect taxes. The non market factors SLBRF and CAPITALF receive factor payments from abroad and transfer to accounts which receive total factor incomes (institutions) ULBRT, SLBRT and CAPITALT. Because factor payments from abroad are

TABLE 5.3
Base Solution
GDP Summary

	Base	Solution Current Prices	Solution Constant Prices	Price Index
GDP at factor cost	1296.100	1296.100	1296.100	1.000
net indirect taxes	175.500	175.500	175.500	
income effect			0.000	
Final Use	1461.500	1461.500	1461.500	1.000
Exports	471.700	471.700	471.700	1.000
Imports	-461.600	-461.600	-461.600	1.000
GDP at Market Prices	1471.600	1471.600	1471.600	1.000
Terms of Trade			0.000	
Gross Domestic Income	1471.600	1471.600	1471.600	
Resource Gap	-10.100	-10.100	-10.000	

Solution Summary

	PSOL	QSOL	YSOL	YBASE
ULBRD	1.000	543.400	543.400	543.400
SLBRD	1.000	357.700	357.700	357.700
AGL-AG	1.000	382.200	382.200	382.300
AGL-FOD	1.000	21.800	21.800	21.800
AGL-CON	1.000	22.900	22.900	22.900
AGL-PTR	1.000	2.700	2.700	2.700
AGL-CEM	1.000	12.800	12.800	12.800
AGL-MAN	1.000	23.900	23.900	23.900
AGL-CNS	1.000	39.100	39.100	39.100
AGL-PSR	1.000	212.900	212.900	212.900
AGL-GSR	1.000	182.800	182.800	182.800
CAP-AGR	1.000	159.900	159.900	159.900
CAP-FOOD	1.000	31.600	31.600	31.600
CAP-CON	1.000	13.100	13.100	13.100
CAP-PETR	1.000	5.800	5.800	5.800
CAP-CHEM	1.000	20.800	20.800	20.800
CAP-MAN	1.000	14.400	14.400	14.400
CAP-CONS	1.000	7.100	7.100	7.100
CAP-PSRV	1.000	140.400	140.400	140.400
CAP-GSRV	1.000	1.900	1.900	1.900
SLBRF			1.800	1.800
CAPITALF			12.500	12.500
ULBRT			543.400	543.400
SLBRT			359.500	359.500
CAPTIALT			407.500	407.500
RHSDY			635.000	635.000
RHSDC	1.000	538.800	538.800	538.800
UHSDY			464.700	464.700
UHSDC	1.000	374.700	374.700	374.700
COMPY			364.400	364.400
	PSOL	QSOL	YSOL	YBASE

TABLE 5.3 (Contd.)

GOVTY			363.000	363.000
GOVTC	1.000	253.800	253.800	253.800
SAV-INV	1.000	294.200	294.200	294.200
IND-TX			175.500	175.500
ACT-AGR	1.000	625.800	625.800	625.800
ACT-FOOD	1.000	320.600	320.600	320.600
ACT-CON	1.000	138.300	138.300	138.300
ACT-PETR	1.000	133.300	133.300	133.300
ACT-CHEM	1.000	115.600	115.600	115.600
ACT-MAN	1.000	142.900	142.900	142.900
ACT-CONS	1.000	162.300	162.300	162.300
ACT-PSRV	1.000	656.200	656.200	656.200
ACT-GSRV	1.000	269.200	269.200	269.200
COM-AGRD	1.000	474.300	474.300	474.300
COM-FOOD	1.000	326.900	326.900	326.900
COM-COND	1.000	131.900	131.900	131.900
COM-PETRD	1.000	92.100	92.100	92.100
COM-CHEMD	1.000	91.000	91.000	91.000
COM-MAND	1.000	151.200	151.200	151.200
COM-CONSD	1.000	162.700	162.700	162.700
COM-PSRVD	1.000	502.900	502.900	502.900
COM-GSRVD	1.000	268.500	268.500	268.500
COM-AGRM	1.000	12.200	12.200	12.200
COM-FOODM	1.000	21.600	21.600	21.600
COM-CONM	1.000	52.700	52.700	52.700
COM-PETRM	1.000	127.500	127.500	127.500
COM-CHEMN	1.000	66.400	66.400	66.400
COM MANM	1.000	188.000	188.000	188.000
COM-PSRVM	1.000	50.200	50.200	50.200
COM-GSRVM	1.000	9.500	9.500	9.500
COM-AGRC	1.000	486.500	486.500	486.500
COM-FOODC	1.000	348.500	348.500	348.500
COM-CONC	1.000	184.600	184.600	184.600
COM-PETRC	1.000	219.600	219.600	219.600
COM-CHEMC	1.000	157.400	157.400	157.400
COM-MANC	1.000	339.200	339.200	339.200
COM-CONSC	1.000	162.700	162.700	162.700
COM-PSRVC	1.000	553.100	553.100	553.100
COM-GSRVC	1.000	278.000	278.000	278.000
COM-AGRX	1.000	153.900	153.900	153.900
COM-FOODX	1.000	36.200	36.200	36.200
COM-CONX	1.000	18.200	18.200	18.200
COM-PETRX	1.000	47.900	47.900	47.900
COM-CHEMX	1.000	32.500	32.500	32.500
COM-MANX	1.000	13.700	13.700	13.700
COM-PSRVX	1.000	168.100	168.100	168.100
COM-GSRVX	1.000	1.200	1.200	1.200
RES-WRD	1.000		567.700	567.700

modelled as exogeneously fixed YSOL will be equal YBASE. However, in the case of RHSDY, UHSDY, COMPY, and IND-TX accounts YSOL and YBASE will differ depending on the income and price effects arising from policy change. The rest of the world account (RES-WRD) has no quantity solution, but its price (exchange rate) is defined. This is explained by the assumption of exogeneously determined foreign capital inflows.

5.4 Sensitivity Analysis

Three experiments have been run to test the sensitivity of the model results to the elasticities given in Table 5.1. These experiments involve a 10 per cent exogeneous increase in the prices of those imports with high intermediate content; namely, CONM, PETRM, CHEMM and MANM. The results are shown in Table 5.4. The model used is a neoclassical type with fixed factors and fixed nominal exchange rate, endogenous investments and exogeneous foreign savings.[4/]

The initial impact of the increase in import prices is to increase composite prices. Since intermediate inputs are bought from the composite accounts this increases the cost of production; leacing to higher activity (gross) output and commodity prices. However, Table 5.4 shows that with low elasticities increases in import prices lead lower activity and commodity prices; with the exception to petroleum. This suggests that with low elasticities domestic and imported goods act as gross complements. However, as the elasticities rise domestic and imported goods behave as substitutes, and the prices of the activities and commodities also rise.

These results can be explained in several ways. Firstly, note that composite goods are a CES aggregation of domestic and imported goods with the elasticity of substitution (σ_i) determining the degree of substitutability. With low σ_i, higher import prices by raising composite prices will reduce the demand for the composite goods. This in turn leads to lower demand for the domestic goods and

TABLE 5.4

Percentage Price changes (from base levels) due to 10% increase in import prices

	Low	Medium	High
Activity -AGR	-5.7	-4.0	-3.0
Activity -FOOD	-4.6	-2.8	-1.7
Activity -CON	-1.9	0.3	1.3
Activity -PETR	7.8	8.6	9.0
Activity -CHEM	-2.6	0.3	1.5
Activity -MAN	-1.8	1.1	2.5
Activity -CONS	-1.0	1.1	2.3
Activity -PSRV	-4.7	-2.9	-1.7
Activity -GSRV	-4.4	-3.2	-2.3
Commodity-AGR	-7.1	-4.9	-3.5
Commodity-FOOD	-5.1	-3.1	-1.8
Commodity-CON	-2.2	0.3	1.5
Commodity-PETR	11.3	12.4	12.8
Commodity-CHEM	-3.7	0.5	2.1
Commodity-MAN	2.2	1.2	2.7
Commodity-CONS	-1.0	1.1	2.3
Commodity-PSRV	-6.3	-3.9	-2.3
Commodity-GSRV	-4.4	-3.2	-2.3
Composite-AGR	-6.9	-4.8	-3.5
Composite-FOOD	-4.8	-2.9	-1.7
Composite-CON	1.2	2.9	3.8
Composite-PETR	10.5	11.0	11.2
Composite-CHEM	2.0	4.4	5.3
Composite-MAN	4.5	6.0	6.7
Composite-CONS	-1.0	1.1	-2.1
Composite-PSRV	-5.7	-3.6	-2.1
Composite-GSRV	-4.3	-3.1	-2.2

hence lower prices. However, as imported goods become more substitutable with domestic goods prices rise not only because of high pass through of the higher import prices, but also due to increased demand for domestic goods. Secondly, the share of imports in the composite good also determines the domestic price response to changes in import prices. The lower (higher) the share of imports the lower (higher) will be the price effects. The share of petroleum imports in total petroleum intermediate inputs is about 90 per cent. This explains why the increase in the price of the imported component of the petroleum sector is almost fully reflected in its price change. However, for non-petroleum products low import shares limit their price increases to smaller magnitudes. The prices of those sectors whose import prices do not change decline in all the experiments. This can be traced to the decline in aggregate demand arising from the deterioration in the terms of trade. The exception is the construction sector which benefits from higher increased savings due to lower consumption.

To summarize, it is evident from the above results that the choice of elasticities crucially affect model results. The changes in the sign and size of activity and commodity prices differ significantly with elasticity changes. This means that in choosing these parameters for use in empirical analysis the structure of the economy being modelled must be appropriately reflected. Because of a general lack of elasticity estimates for Kenya, we have used the best available estimates; and in some cases what we consider the most realistic values. More specifically, for our simulations we use the low values of the elasticities of substitution between the two labour types (ε_{LL}) and the medium values for the rest of the elasticities

(ε_{lk}, ε_{dm} , ε_x , and ε_t) given in Table 5.1.

As discussed in Section 5.2, the choice of ε_{LL} follows from our assumption of low substitution between skilled and unskilled labour. The choice of the elasticities of substitution between aggregate labour and capital (ε_{LK}) is less problematic because the values used are based on estimates derived from Kenyan data; and, moreover, these estimates fall within the expected values for LDCs. Because of high sectoral aggregation trade (Armington) elasticities (ε_{dm}) are by convention assumed to be low, usually around unity. Our choice of these parameters reflect this assumption. The exceptions are agricultural commodities, foods and consumer goods which, because they are assumed to be highly homogeneous, have been assigned elasticities greater than unity. Our choice of the export demand elasticities follow the widely accepted assumption that these elasticities range from 2.0 to 6.0 for LDC products. The choice of the elasticities of transformation (ε_t) is problematic because there are no estimates for LDCs. The high values of ε_t in Table 5.1, and used in models for Turkey by Grais et al. (1986) and Condon et al. (1985), are guesstimates. Tarr (1989) uses relatively high values in a model of USA quantitative restrictions; specifying ε_t of 1.6, 2.9 and 4.2 as low, medium and high values, respectively, for various manufactured commodities. These are reasonable estimates for a developed economy but for LDCs, where it is more difficult to shift resources from the production for domestic to export markets, lower estimates are more realistic.

5.5 Closure Rules

Our basic model has 780 cell equations and 791 variables which means that the model is underdetermined. To make it fully determinated eleven variables have to be fixed. Which of these variables are to be made exogenous leads to the problem of closure rules.[5/] The widespread application of CGE models in the late 1970s and 1980s has led to a long running debate as to the appropriate macroclosures. This debate is a result of the realisation that the choice of macroclosure determines model results. The original work on this issue is Sen (1963); while the initial debate started with Bruno (1979), Taylor and Lysy (1979), Lluch (1979), and Bell (1979). The issue is also extensively discussed in Taylor (1983), Rattso (1982), Dervis et al (1982), Robinson (1989), and Adelman and Robinson (1988)

In the context of economy wide models the macroclosure debate is basically about how aggregate investment is to be equated with aggregate savings. The debate however has been expanded to include how different markets are cleared. When the economy is opened the issue of "external closure" arises. The debate about "external closure" revolves around whether the exchange rate is fixed or flexible. However, as discussed in Chapter 3, Whalley and Yeung (1984) and de Melo and Robinson (1986) have extended the debate to include assumptions about the specification of export demand functions and product differentiation of traded goods.

To understand the implication of closure rules on CGE results it is useful to set up a small model. We use the now famous Sen's (1963) model for this purpose. This is a one-sector model producing one good under constant returns to scale. Capital and labour are the only factors production, and are assumed to be available in fixed supply. Firms are assumed to distribute all incomes to households; and that consumption out of wage income is greater than that from profits. Investments are assumed tobe financed by savings. The model is specified as:

$$Y = F(K,\ L) \tag{5.8}$$

$$\frac{w}{p} = F_L\ (K,\ L) \tag{5.9}$$

$$Y = (\frac{r}{p})K + (\frac{w}{p})\ L \tag{5.10}$$

$$I = s_r(\frac{r}{p})K + S_w\ (\frac{w}{p})L \tag{5.11}$$

$$I = \bar{I} \tag{5.12}$$

$$L = \bar{L} \tag{5.13}$$

$$K = \bar{K} \tag{5.14}$$

where w, r and p are wage rate, profits and commodity price, respectively. Returns to factors are therefore given in real terms. Y, K, L and I are output, capital, labour and investment, respectively; F is the production function and F_L is the marginal product of labour; and lastly, s_r and s_w are savings out of profits and wage incomes, respectively. With all the variables defined, the equations are self-explanatory. The model has seven independent equations and six variables (Y, K, L, I, w/p, r/p) and the system is therefore overdetermined. The choice of closure rule is therefore about which of the seven equations should be dropped.

Sen (1963) distinguished four different macroclosures; namely, the Neoclassical, the neo-Keynesian or what has come to be known as Kaldorian, the Johansen, and the General Theory (Keynesian). The debate among the modelers concerns the theoretical justification for the choice among these closures. Models of LDCs have used several variants of the Keynesian closure. Such models, especially Taylor and Lysy (1979) have expanded the debate to include the issues of what constitutes a true Keynesian model and the interpretation of its results.[6/]

A typical neoclassical closure drops (5.12) and investments are endogeneously determined. This means that planned investments adjust to available savings; with the two variables being brought to equality by a mechanism outside the system, for example, the interest rate. In addition, the neoclassical closure assumes full employment and flexible exchange rate under open economy model. The model therefore specifies a system in which prices clear the markets. The significance of this closure is that with resources fully employed and factors paid their marginal products, output is determined only on the production side. The demand side plays little role. Moreover, because the model retains most Walrasian features, it is easy to follow the channels through which the system is brought into equilibrium. Neoclassical assumptions however do not reflect realistic structures of LDC economies; hence the neoclassical closure is rarely used to model these economies.

The neo-Keynesian closure drops (5.9), the condition that the real wage equals the marginal product of labour. The exogeneity of investments means that savings must adjust to meet planned investments. Given that labour can be paid less than its marginal product and with full employment, income will be redistributed from wage earners to the high saving capitalists. The resulting increase in savings serves to attain investment-savings equilibrium.

Under the Johansen closure (5.11) is dropped so that savings and investments are not explicitly equated in the model. With full employment and exogeneous investments, the system is closed by a mechanism outside the model. One possibility is through the endogeneous change in consumption induced, for example, by taxes or subsidies. For instance, an exogeneous increase in investments increases disposable income and hence consumption. To maintain equilibrium higher taxes can be used to equate private consumption and output and hence implicitly savings and investments. Alternatively, where government consumption is fixed in nominal terms or is endogeneously determined, active fiscal policy can be used for the purpose.

The Keynesian closure assumes that (5.13) is dropped. The relaxation of the full employment condition leads to the deviation between investments and savings being mediated through changes in employment and output. For the example, increase in investments will lead to increase in real output, which must be preceded by increase in employment. Higher employment will generate increased incomes and hence savings.

The most widely used Keynesian model may be called the Taylor model after its major proponent. A typical Taylor model [see Taylor (1979, 1983) and Taylor and Lysy (1979)] assumes exogenous investments and endogenises the level of employment. It also fixes the nominal wage as the numeraire and assumes different savings rates between wage earners and the capitalists. The specification of this model implies rather unorthodox equilibrating mechanisms. The unemployment assumption means that the wage rate is no longer the equilibrating mechanism in the labour market. Firms are assumed to be always on their demand curves so that labour supply adjusts to meet demand. With investments fixed exogenously there is a need for some variable to equate aggregate savings and investments. In a typical Taylor model this variable is the price level. The equilibrating process takes the following route. Given that wages are fixed in nominal terms a rise in the price level lowers the real wage. This induces firms to increase employment which leads to greater output and therefore increased savings through higher incomes. An open economy Keynesian model with fixed exchange rates complicates the equilibrating mechanism. In this case foreign capital inflows complement domestic savings. Some Keynesian models, notably the Taylor type models also include the Kaldorian features in their specification, so that increase in savings partially results from income distribution.

The choice of closure in CGE models depend on the characteristics of the economy being modeled and the type of issues at hand. The prominence of macro structuralist models of the Taylor type lies in their attempt to capture the realities of LDC economies. The realism of the macro structuralist models however has to be weighed against the fact that some of their assumptions undermine the microfoundations of Walrasian theory. On the other hand, as discussed above, neoclassical models while remaining closely faithful to Walrasian system are at variance with the realities of LDC economies.

Below we simulate the effects of a 10% increase in import prices under the Neoclassical and Keynesian macroclosures. Experiments are carried out under assumptions of fixed and flexible exchange rates. This means we have four experiments which we have named models 1-4. We also assume product differentiation between domestic and imported goods (Armington assumption) and between domestically consumed and exported gross output. As discussed in Section 5.4 thc low values of elasticities of substitution between skilled and unskilled labour and the medium elasticities in the other cases shown in Table 5.1 are used in the simulations.

Model 1 is a typical neoclassical model with full employment and flexible exchange rates. The urban household consumer price index is used as a numeraire. The current account is exogenously fixed in foreign currency and hence should balance. Model 2 is a Keynesian closure with the urban wage fixed as numeraire; investments are also exogeneously fixed.7/ Model 3 is a variant of the neoclassical closure However, unlike model 1 its closure includes fixed nominal exchange rates and exogenously fixed investments. With a fixed nominal exchange rate the current account is endogeneously determined. Foreign savings will therefore adjust to close the aggregate savings-invesments gap. Model 4 is a variant of Model 2, but has a fixed exchange rate. However, like model 2 the urban wage is used as a mumeraire; the real exchange rate is therefore fixed.

The model we shall use for our empirical analysis is a modified version of model 4. It follows (though not too closely) the Keynesian macroclosures along the Taylor tradition. The supply of unskilled labour is fixed so that its market is cleared by wage adjustments. The SAM data shows that 70% of total unskilled labour is employed in the agricultural sector; and furthermore, 90% of total labour employed in this sector is unskilled. Existing evidence suggests that there is a shortage of labour in rural Kenya (Collier and Lal (1986), Fallon (1986)), especially in the most productive areas. Collier and Lal (p. 92) show that because of high labour demand, the real wage increased by 32% between 1968-78 in the small holder agricultural sector.

The wage for skilled labour is assumed to be fixed in nominal terms. This follows from the fact that wages in the formal sector are in most part institutionally fixed. Empirical evidence show that real wage adjustments have been on a downward trend since the mid 1970's.[8/] Collier and Lal (p.93) show that the real wage of skilled labour declined by 18% between 1968-77 and by a further 10% in 1977/78. Most of these wage adjustments occured from the mid-1970's out of deliberate government policy. This would seem to support the assumption that skilled wages are fixed in nominal terms.

Most of the studies on Kenya have specified only one (aggregate) labour category and have assumed a variety of wage determination mechanisms without convincing justification. Dick et al. (1983) assumed fixed nominal wages, while Gupta and Togan (1984) assumed fixed real and flexible wages in various experiments for an aggregate labour category. The assumption of fixed or flexible economywide wages is unecessarily too general. Blomqvist and McMahon (1986) assume fixed real wage for urban industrial labour which is unrealistic for the reason stated above. Roe and Pal (1986) categorise the labour markets as rural and urban and assume that wages clear the urban labour market, while unemployment is assumed to exist in rural areas. Again these assumptions are not supported by the existing evidence on Kenya's labour market.

Because of the short-run nature of our model we assume fixed and sector-specific capital. Most of the models of Kenya use the same assumption. The assumption of mobile capital by Dick et al (1988) in an essentially short-run model is not justified. For external closure we assume a fixed exchange rate regime; which in fact prevails in Kenya. However, unlike most Keynesian models we do not allow foreign savings to fill the gap between domestic savings and planned investments; hence we assume exogeneously fixed foreign capital inflows. This basically means that Kenya is constrained from borrowing in foreign capital markets. The main difference between our model and the Taylor type models is that we do not exclusively assume exogeneously fixed real investments. In the absence of sound analysis of investment behaviour in the Kenyan economy there is little theoretical justification in favour of any of the two savings-investment closures. The argument that investment is exogeneously fixed in the short-run seems reasonable. However, in the face external shocks and the resultant structural adjustments it is difficult to justify the assumption that planned investment is always realised.

Table 5.5 shows the changes in the macroeconomic aggregates of the model resulting from a 10 percent increase in import prices. The aim of the experiments is to determine how the alternative closures affect model results, and therefore the importance of the assumptions we make about the structure of an economy.

To begin with, notice that the increase in import prices lead to a deterioration of terms of trade by between 35-40%; the effect of which is to depress the economy. This is clearly manifested by the decline in real GDP and household consumption in all the models.

To analyse the implication of each closure we start with model 2 which exhibits the most interesting results. The first thing to note is that even with a depressed economy this model leads to higher prices. GDP deflators at factor and market prices go up by 3.0% and 4.3% respectively; while consumer price indices rise by a range between 3.7% and 7.1%. Export prices go up by 10.4% and import prices rise by 20.7%. This inflationary phenomenon is a result of the increases in the wage rate of unskilled labour, the high devaluation of the exchange rate, and the increases in imported intermediate input prices.

The high prices of model 2 leads to lower aggregate demand. This is typified by the decline in rural household, urban household

TABLE 5.5

Percentage Change (from base values) in Macroeconomic Aggregates Due to 10% Increase in Import Prices

(A) Prices	Model 1	Model 2	Model 3	Model 4
GDP at factor cost	-3.7	3.0	-3.1	-2.3
GDP at market prices	-2.7	4.3	-2.2	-1.4
Exports	1.6	10.4	0.0	0.2
Imports	10.4	20.7	8.1	8.0
Unskilled labour wage	-3.2	4.4	-2.8	-2.8
Skilled labour wage	-3.9	0.0	-2.8	0.0
Capital - AGR	-2.7	5.9	-2.6	-2.8
Capital - FOOD	-3.3	1.9	-4.2	-3.7
Capital - CON	-2.0	5.6	-2.5	-2.5
Capital - PETR	-22.5	-14.5	-21.3	-21.4
Capital - CHEM	-0.6	11.3	-0.3	-0.9
Capital - MAN	-9.5	3.2	-2.9	-2.1
Capital - CONS	-13.0	3.3	-1.3	-0.7
Capital - PSRV	-5.1	1.5	-4.7	-4.4
Capital -GSRV	-0.4	-5.7	-0.6	-1.6
RHSDC - CPI	-1.4	6.0	-1.0	-0.6
UHSDC - CPI	0.0	7.1	0.4	1.0
GOVTC - CPI	-1.9	3.7	-1.3	0.3
Investments	4.1	12.9	4.0	4.4
Exchange Rate	2.2	11.6	0.0	0.0
(C) Values				
Balance of Trade	-63.60	-77.64	-203.36	-207.94
Balance of Payments Deficit	2.20	11.62	34.64	36.07
Terms of Trade	-37.75	-40.56	-35.13	-40.0
(D) Quantities				
GDP at factor cost	0.0	-0.04	0.0	-0.49
GDP at market prices	-0.45	-0.40	-0.26	-0.73
Exports	0.46	1.51	-0.45	-0.90
Imports	-6.32	-5.55	-3.62	-3.73
Unskilled labour	0.0	0.0	0.0	0.0
Skilled labour	0.0	-0.13	0.0	-1.77
RHSD - Consumption	-1.96	-2.26	-1.92	-2.07
UHSD - Consumption	-3.58	-4.82	-3.17	-3.27
GOVTC - Consumption	1.97	-3.54	1.35	-0.28
Investments	-6.61	0.0	0.0	0.0
Employment-AGR	0.45	1.15	0.15	0.01
Employment-FOOD	0.26	0.20	-1.08	-2.03
Employment-CON	1.20	2.63	0.28	-0.94
Employment-PETR	-15.04	-11.93	-14.63	-16.0
Employment-CHEM	1.60	4.95	1.26	-0.10
Employment-MAN	-4.28	1.18	-0.06	-0.84
Employment-CONS	5.0	0.84	0.74	0.20
Employment-PSRV	-0.93	-0.16	-1.15	-2.00
Employment-GSRV	1.71	-3.36	1.10	-0.05

and government consumption by 2.26%, 4.82% and 3.54%, respectively. The effect of the decline in aggregate demand spreads to the sectoral level and other markets in the economy. One such effect is the decline in the employment of skilled labour. The model however shows a different adjustment process for the unskilled labour category. With the supply of this labour type fixed, change in the real wage rate clears the market. The increase in the wage of unskilled labour in this model is solely due to the growth of the agricultural sector (as shown by increase in employment) in which it is used intensively. This sector grows relative to the others because it uses less imported inputs whose prices have gone up.

In this model it is also evident that returns to capital are high. This is a result of higher employment in the AGR, CON, CHEM, FOOD, PSRV sectors which raises the capital-labour ratios and hence profits. The decline in employment and hence profitability in the public sector is due to a decline in government consumption. On the other hand, the decline in employment and profitability of the petroleum sector is explained by the fact that it is a major user ofimported intermediate inputs.

Given the flexible exchange rates and with the current account exogeneously fixed in foreign currency in model 2, a high devaluation is necessary to balance the external account. The 11.6% devaluation not only reduces the demand for imports but also increases the competitiveness of domestic exports. The increase in exports however is not enough to avert an increase in the balance of trade deficits. The current account deficit also increases, but only by the rate of devaluation.

In model 4 the Keynesian multiplier effects associated with lower aggregate demand are greatly magnified compared to those of model 2. This can be seen from the higher declines in the growth of real GDP and employment; which are accompanied by declines in factor rewards and the price levels. The decline real GDP is also explained by the leakages arising from the increase in foreign savings, resulting from fixed nominal exchange rates, which finances the large trade deficits. Comparing the results of the two models, it is clear that the type of closure chosen matters.

Under the neoclassical closure factors of production are fixed and fully employed. In this model growth can only be generated by reallocation of factors among sectors. The low growth in real GDP at market prices in model 1 therefore implies that the gains from such factor reallocation are minimal. As with the Keynesian closures, lower aggregate demand leads to lower real GDP, lower general price levels and lower returns to factors. Low economic growth also translates to lower pressure to devalue the domestic currency. The 2.2% devaluation contrasts sharply with the 11.6% devaluation of model 2. The effect of the devaluation is to reduce the growth of imports and increase that of exports. However, as is the case in model 2, neither the current account nor the balance of trade is improved by the increase in import prices and devaluation.

The exogeneity of investments in model 3 makes it not a typical Neoclassical model. In this model imports and investments are financed by foreign capital inflows represented by the higher deficits in the balance of trade and the balance of payments. This moderates the decline in real GDP at market prices. It is also noticeable that for most other variables the two neoclassical models are closely similar. This is true with respect to changes in factor earnings, price and consumption levels. This is because policy changes only work through the production side in neoclassical models and hence are more stable than the Keynesian models. It is still true however that the choice of external closure matters in the two neoclassical models.

5.6 Conclusion

To conclude, we have shown that model results are sensitive to the choice closure rules. Specifying a model along neoclassical or Keynesian lines and alternative external closures lead to different results. It has also been shown that neoclassical models generate more stable results than the Keynesian model. This is explained by the fact that under the neoclassical models adjustments only work through the production side, and since the factors of production are fixed the response to policy changes are minimal. In contrast, output in the Keynesian models is determined through both the production and consumption sides of the economy. In these models the multiplier process magnifies the changes in output through changes in employment and consumption.

It was argued above that the Keynesian model best represents the structure of the Kenyan economy. We shall therefore use this model in our empirical analysis. The macroclosure of our model can be summarised as follows:

(1) Supply of skilled and unskilled labour is assumed fixed; with the

excess demand for unskilled labour cleared by wage adjustments while unemployment of skilled labour is allowed through fixed nominal wage specification. The unskilled labour wage is also set as a numeraire.

(2) Supply of capital is also fixed, but is sector specific. Returns to capital are therefore potentially different among sectors.

(3) The exchange rate is assumed fixed; hence given the fixed relative price, the real exchange rate will be endogeneously determined. However, unlike most models which allow unconstrained external borrowing, we assume exogeneously fixed foreign capital inflows. Capital formation will therefore be heavily dependent on domestic savings.

(4) Since we find no justifiable reasons for specifying investments as being determined either exogeneously or endogeneously the results of both models will be reported.

(5) Government consumption is exogeneously fixed in nominal terms. A change in government budget will therefore spill over into aggregate demand.

The implication of these assumptions will become apparent in the next chapter where they form the basis of the policy experiments. While the specified model may not fully reflect the structure of the Kenyan economy we believe that it is realistic enough and appropriate for our purposes.

CHAPTER SIX

SIMULATION RESULTS

6.1 Introduction

This chapter simulates the consequences of trade policy changes on the Kenyan economy. This is done by running experiments involving tariff reductions, devaluation of domestic currency and export subsidies. In practice, these policies are implemented with the aim of stimulating efficient allocation of resources and hence higher output and economic growth. The purpose of this Chapter is to examine the extent to which these results are achieved in our model. In particular, we analyse the effects of the policy changes on factor and commodity prices, output and consumption levels, the volume of trade, and factor allocation among sectors. The policy effects on macroeconomic aggregates such as price indices, real GDP, trade balance, and the balance of payments will also be examined.

It is important to reiterate that our model is short-run in nature; with sector-specific capital and mobile labour. However, the total supply of both factors is fixed. The model is also comparative static. This means that issues normally associated with dynamic models such as the adjustment costs and hence the timing and the sequencing of liberalisation do not arise. For most part, the simulations are made under the assumption of perfect competition and constant returns to scale in production. Commodity markets are cleared by prices, but other markets, for example, labour and external markets are cleared depending on the assumed closure rule.This applies to the simulation results reported in Sections 6.2 and 6.3. In Section 6.2 the results of tariff reductions are reported, while those of devaluation and export subsidies are reported in Section 6.3. Alternative simulations which take into account the effects of quantitative restrictions and the deviations from marginal cost pricing are also made. Section 6.4 reports the results involving the effects of import controls. With import quantities fixed under a fixed exchange rate regime some price mechanism will adjust to clear the excess demand for imports. It is usual to model changes in import premia as the clearing mechanism. In this study we simulate the effect of exogenous increase or decrease in the volume of imports on the domestic economy. This endogenises import price changes which clear the excess demand for imports. In Section 6.5 results involving mark-up prices are reported. The production technology and price formation in this model differs from those of the other sections. This specification allows us to examine the implication of deviation from the competitive system.

6.2 Model Results from Tariff Reductions

It was shown in Chapter 3 that with qualitative models unambiguous effects of tariff reductions could only be obtained by assuming that imports were either competitive or non-competitive. This is largely because such models cannot take into account the role of import shares and the elasticities of substitution between imported and domestic goods. Since empirical models incorporate these features these problems do not arise. For example, the elasticities of substitution in effect define the competitiveness and therefore the relative changes in demand for domestic and imported goods due to tariff reductions. The interpretation of our results therefore avoids the problems associated with the qualitative models.

In this section we simulate the effects of trade liberalisation in the form of a 50 percent tariff reduction on all imported goods. Four simulations (E1-E4) characterised by different macroclosures are carried out. Experiment E1 is a Keynesian model; with unskilled labour market assumed to clear through wage adjustments while quantity adjustments clear the market for skilled labour. It also assumes endogenous investments, government consumption fixed in nominal terms, a fixed exchange rate and exogenous capital inflows. Experiment E2 while retaining the labour market closures and exogenous capital inflows of E1 assumes fixed real government consumption, exogenous investments and a flexible exchange rate regime. The exogenous investments in this case rely mainly on domestic savings. E3 retains the assumptions of E2 except that it assumes a fixed exchange rate and endogenous foreign capital inflows. This means that domestic savings are supplemented by foreign savings in the determination of investments.

Experiment E4 is a typical neoclassical model. All factor supplies are assumed fixed with wages clearing the labour markets. It also assumes a flexible exchange rate regime and fixed capital inflows. Government consumption is fixed in real terms and investments are assumed to be endogenously determined by domestic savings. The price system is therefore the major market clearing mechanism in this experiment.

As argued elsewhere in this thesis, the Keynesian closures represent the most realistic features of the Kenyan economy. The three Keynesian models are therefore simulated in order to examine how changes in assumptions about the structure of the economy and agents behaviour affect the results. This is important because changes in some closures in effect represent changes in policy. In our cases this is true with respect to the changes in the specifications of government consumption and exchange rate. Since we have no firm a priori justification for favouring either of the two investment closures, E1 and E3 are run for comparative purposes. The static nature of the model and the sector-specificity of capital would seem to favour the assumption of exogeneity of capital. However, it seems realistic to allow for the possibility that the desired level of investment may not be realised even within one period. E2 has been run not only to examine the implications of a flexible exchange rate regime, but also for comparison with the neoclassical E4.

Table 6.1 gives a summary of the changes in some macroeconomic aggregates from the four experiments. To start with, the growth of GDP in all the simulations is not remarkable. Furthermore, it differs with the type of closure. What is noteworthy is the similarity of GDP changes between E1 and E4. This result can be traced to the changes in employment in the two experiments. In the case of E4, the low or no growth is a manifestation of fixed factors. On the other hand, given fixed quantities of unskilled labour in E1, tariff reductions lead to a 0.01% reduction in the employment of skilled labour. This negative growth in employment, by reducing the growth of output, leads the Keynesian closure to behave like the neoclassical closure E4.

TABLE 6.1

Percentage Change (from Base Values) in Macroeconomic Aggregates Due to 50% Tariff Reductions

(A) Prices	E1	E2	E3	E4
GDP at Factor Cost	-0.1	9.4	1.7	2.6
GDP at Market Price	-2.7	6.9	-0.9	0.0
Exports	-0.4	12.1	-0.8	2.7
Imports	0.0	13.8	-0.1	3.2
Exchange Rate	0.0	13.8	0.0	3.2
Rural Household - CPI	-2.0	9.6	0.3	0.8
Urban Household - CPI	-2.7	7.0	-1.1	0.0
Government - CPI	-1.2	4.1	-0.3	1.3
Investments - CPI	-4.6	6.6	-3.0	-1.7
Unskilled Labour Wage	-0.4	13.0	2.3	2.6
Skilled Labour Wage	0.0	0.0	0.0	2.2
(B) Values				
Balance of Trade	0.12	-16.52	-139.21	-3.31
Balance of Payments	0.0	13.79	31.58	3.21
Terms of Trade	-37.75	-40.56	-35.13	-34.0
(C) Quantities				
GDP at Factor Cost	0.0	1.49	0.31	0.0
GDP at Market Prices	0.0	1.50	0.46	0.03
Exports	1.11	3.34	0.67	1.35
Imports	0.69	2.24	3.58	0.89
Rural Household Consumption	1.81	1.90	1.80	1.74
Urban Household Consumption	2.68	1.70	2.74	2.39
Government Consumption	1.17	0.0	0.0	0.0
Investments	-8.47	0.0	0.0	-6.88
Unskilled Labour	0.0	0.0	0.0	0.0
Skilled Labour	-0.01	5.38	1.12	0.0

The growth of GDP in experiments E2 and E3 is clearly due to the overall growth of employment. In the case of E2, Keynesian multiplier effects lead to a higher increase in demand for labour; which leads to an increase in employment of skilled labour by 5.38 percent. However, because of the low elasticities of substitution between unskilled and skilled labour, the increase in employment is only possible with a 13 percent increase in the wage of unskilled labour. This leads to the 9.4 percent increase in the GDP deflator at factor cost. The inflationary situation arising from the increase in wage costs and the 13.8 percent devaluation moderates the growth of GDP which would otherwise be higher due to the increase in employment. In contrast to E2, the relatively lower increase in employment in E3 is the main contributor to the lower growth in GDP. This is largely a result of the external closure which by introducing leakages reduces the Keynesian multiplier effects. In other words, the increase in imports reduces the aggregate demand for domestic goods and hence economic growth.

The effect of trade liberalisation on consumer prices and hence on the levels of consumption is apparent in all the experiments. Notice that urban household consumer prices are lower than those of rural households. This is reflected in the higher consumption levels of urban households relative to rural households. This difference is due to the fact that tariff reductions imply lower prices of imported goods; a high proportion of which are consumed by urban households. As will become clear shortly, liberalisation increases the prices of agricultural goods which are mainly consumed by rural households. This explains the relatively higher rural household CPI and hence lower consumption. It is also clear from Table 6.1 that the devaluations in E2 and E4 translate into higher CPIs. This effect is most pronounced in E2 where rural and urban household CPIs rise by 9.6 and 7.0 percent, respectively. Note that in this case urban household consumption is relatively lower. Contrary to the other cases devaluation here increases import prices to the extent of lowering the real demand of the urban households. The inflationary nature of E2 however dampens the consumption of both households.

In E1, with government consumption fixed in nominal terms, a lower CPI leads to higher consumption. In the rest of the experiments the consumption is fixed in real terms, so that the level of consumption is maintained at any given prices primarily by savings adjustment. Since the government consumes only one commodity, government services, its consumer price index will always be equal to the price of this commodity.

Changes in investment demand depend on the assumed macroclosures. The endogeneity of investments in E1 and E4 means that the increase in consumption and hence decline in savings reduces the volume of investments. The fall in the demand for investments is reflected by the decline in the investments price indices in the two experiments. On the other hand, with fixed real investments in E2 and E3,some other adjustment mechanism must close the system. In E2 where the Keynesian multiplier effects dominate, this happens through increased output and savings. The high price increases in this model lead to lower real wages of skilled labour which in turn generate higher employment and hence higher output. Savings by rural and urban households, and by companies rise by 11.69% and 8.81% and 12.97%, respectively. This, together with the 13.79% increase in foreign savings, helps to finance the desired investments. The losses in tariff revenue from the policy change together with increased government consumption however leads to a 10% decline in government savings. In the case of E3 households' and company savings go up by around 2%, while government savings decline by 37.4%. Investments are therefore mainly financed by a 31.58% increase in foreign savings. This is particularly so given that there are hardly any Keynesian multiplier effects in this experiment. The slow growth in output together with the higher consumption levels generate lower savings compared to E2. Note also that the increase in foreign capital contribute to the lower price of domestic investments.

Table 6.1 also shows changes in aggregate exports and imports, balance of trade and balance of payments. In general, changes in these variables depend on the type of external closure used. In experiments E2 and E4 with flexible exchange rate regimes, tariff reductions lead to the devaluation of the Kenya Shilling. As imports become cheaper the domestic currency appreciates to balance the current account. The devaluation is higher in the case of E2 because the higher demand associated with the Keynesian multiplier effects would otherwise lead to higher imports. In both experiments, the effect of devaluation is to improve export performance. This however does not lead to an improvement in the balance of trade. What would appear surprising is that, even with the specification of fixed capital inflows, foreign savings (BOP) rise in the two experiments. This result arises from the fact that devaluation raises the domestic currency values of foreign capital inflows and payments. In E1 with a fixed exchange rate this does not occur and the current account is balanced. Meanwhile, in experiment E3, endogenous capital inflows under a fixed change rate regime generates the opposite results. The relatively high increase in the volume of imports and the low increase in exports, results in a large decline in balance of trade and deterioration of BOP deficits.

Table 6.2 shows returns to factors and employment levels in each sector. It should be emphasised that sectoral wage rates reflects the proportion of unskilled labour employed in each sector. For example, with unskilled labour mainly employed in the agricultural sector, the 0.4 percent decline in unskilled labour wage in E1 (Table 6.1) is fully reflected in the decline of the aggregate wage rate in the sector. Lower wage decline in the other sectors reflects a lower proportion of unskilled labour employed in them. This pattern is repeated in the other experiments where higher labour demand increases wages in all the sectors. It is also worth emphasising that with the nominal wages of skilled labour fixed in the Keynesian closures, changes in the price level will lead to changes in real wages and hence the overall level of employment.

As shown in Table 6.1 the employment level of skilled labour depends on real wage movements; for example, decreasing with the increases in real wage in E1 and increasing with the decline in real wages E2 and E3. A more interesting pattern of changes employment levels emerges at the sectoral level. Changes in the aggregate sectoral employment in all the cases reflect intersectoral resource allocation. It is usually argued that tariff reduction, bylowering protection reduces activity in the import competing sectors, leading to unemployment. On the other hand, export oriented sectors will experience increased employment and output. This is supported by the results in Table 6.2. On the whole, employment rises in GSRV and in the export oriented sectors AGR, PETR, PSRV and CHEM. Employment however declines in the highly protected sectors CON, MAN, and in the non-traded sector CONS.

The differences in the sectoral employment levels result in differences in profitability among the sectors. It is evident from Table 6.2 that those sectors with positive growth in employment also show increased returns to capital. This result conforms to the

TABLE 6.2

Percentage Changes (from Base Values) in Factor Prices and Employment Due to 50% Tariff Reduction

	E1	E2	E3	E4
(A) Factor Prices				
Wage - agriculture	-0.4	12.7	2.2	2.6
Wage - foods	-0.1	4.8	0.8	2.3
Wage - consumer goods	-0.1	5.7	1.0	2.3
Wage - petroleum	-0.1	3.8	0.7	2.3
Wage - chemical	-0.1	3.1	0.5	2.2
Wage - manufactures	-0.1	4.3	0.8	2.3
Wage - construction	-0.1	4.7	0.8	2.3
Wage - private services	-0.1	5.1	0.9	2.3
Wage - government services	-0.1	2.6	0.5	2.2
Capital - agriculture	-0.4	14.6	2.4	2.8
Capital - foods	0.4	8.7	0.1	2.9
Capital - consumer goods	-1.5	11.2	-0.4	1.4
Capital - petroleum	18.2	37.9	21.7	22.3
Capital - chemicals	-0.7	18.0	2.4	3.1
Capital - manufactures	-8.1	8.6	-0.3	-0.4
Capital - construction	-5.2	5.3	1.0	-10.5
Capital - private services	1.5	12.9	3.4	4.3
Capital - government services	2.4	3.5	0.8	2.5
(B) Employment				
Employment - AGR	-0.01	1.21	0.14	0.13
Employment - FOOD	0.41	2.82	-0.55	0.41
Employment - CON	-1.0	3.90	-1.04	-0.68
Employment - PETR	13.41	22.78	15.26	14.07
Employment - CHEM	-0.28	6.98	0.09	0.42
Employment - MAN	-5.64	2.88	-0.75	-4.38
Employment - CONS	-7.87	0.28	0.08	-6.49
Employment - PSRV	0.97	4.40	1.49	1.14
Employment - GSRV	1.22	0.43	0.16	0.14

predictions of sector-specific models; whereby sectors experiencing increases in labour employment will have higher capital-labour ratios

and hence increases in returns to capital. This result indicates that trade liberalisation will, in general, increase the profitability of export oriented sectors and lower the profitability of highly protected and non-traded sectors.

The changes in employment and profitability will be carried over to changes in activity and commodity prices and quantities in each sector. The effect of trade liberalisation on the prices and quantities, are given in Tables 6.3 and 6.4. In all, there are five prices to consider. These are prices for gross output, domestic and composite commodities, imports and exports. The effect of trade policy on each of these prices crucially depends on how it is formed. In Chapter 4 the formation of the various prices is discussed.

At the risk of being repetitive we provide a brief summary of how these prices are formed. As shown in Chapter 3 the formation of gross price (3.8) is specified as:

$$PX_i = PN_i + \sum_j a_{ji}P_j \tag{6.1}$$

This shows that gross prices are made up of net prices and intermediate costs. Changes in PX_i can therefore be traced to the changes in PN_i through changes in factor prices, and changes in composite prices (P_j) through changes in domestic (PD_i) and import prices (PM_i). It was also shown in Chapter 3 that the assumption of imperfect substitutability between gross output sales for domestic and export market means that PX_i is an average sales price and hence will lie between PD_i and PE_i; where PE_i is the domestic currency price of exports. Similarly, the Armington assumption implies that the P_j is an aggregation of domestic and import prices; and will lie between the two prices. For policy purposes it is important to bear in mind that these prices (except PX_i) are valued at market prices. For instance PD_i, PE_i, PM_i are inclusive of domestic indirect taxes, export taxes (or subsidies) and import duties, respectively. It is through the change in these commodity taxes as a result of policy change that activity and commodity prices and hence output change. We now examine the effect of tariff reductions on the prices and quantities of gross output and the commodities.

The effect of tariff reductions on domestic prices depend on sectoral import shares and the elasticities of substitution between imported and domestic goods. Higher import shares and elasticities of substitution will generate a greater price response. With higher elasticities of substitution it is much easier to substitute imports for domestic supplies; so that tariff reductions will lower domestic prices through lower demand. The level of price changes also depends on the initial tariff rate in each sector. Those sectors with high tariff rates will experience greater price reductions.

Table 6.3 shows the percentage change in the prices of gross output and the various commodities due to trade liberalisation. As a result of fixed exchange rates tariff reductions lead to a similar decline in import prices in E1 and E3. However, it is also evident that in all the experiments price response is greater for those imports with the highest tariff rates. This is true for commodities, FOOD, CON, PETR, MAN and CHEM whose tariff rates are 22.8, 28.2, 17.8, 15.4 percent, respectively. The commodities AGR, PSRV and GSRV which face low or no duties (that is, 6.0, 0.0, 3.2 percent, respectively) and have low import shares, show little price response. Although PETR has a high import ratio the fall in its import price is moderated by the low elasticity of substitution (0.66). In a similar way AGR, FOOD and CON, though they have low import

TABLE 6.3

Percentage Changes (from Base Values) in Activity and Commodity Prices Due to 50% Tariff Reduction

	E1	E2	E3	E4
ACTIVITY - AGR	-0.7	12.7	1.9	2.3
ACTIVITY - FOOD	-1.8	9.0	0.0	0.9
ACTIVITY - CON	-3.8	6.1	-2.5	-0.1
ACTIVITY - PETR	-7.2	5.3	-6.5	-4.3
ACTIVITY - CHEM	-2.9	8.8	-1.3	0.0
ACTIVITY - MAN	-4.6	6.0	-2.9	-1.7
ACTIVITY - CONS	-4.5	5.5	-2.6	-1.6
ACTIVITY - PSRV	-1.3	7.3	0.1	1.4
ACTIVITY - GSRV	-1.1	3.8	-0.3	1.3
DOMESTIC - AGR	-0.8	12.6	2.3	2.1
DOMESTIC - FOOD	-2.0	8.6	0.0	0.7
DOMESTIC - CON	-4.3	5.2	-2.9	-1.6
DOMESTIC - PETR	-10.6	1.6	-9.6	-7.8
DOMESTIC - CHEM	-4.0	7.2	-1.7	-1.1
DOMESTIC - MAN	-5.2	5.2	-3.2	-2.3
DOMESTIC - CONS	-4.5	5.5	-2.6	-1.6
DOMESTIC - PSRV	-1.6	6.0	0.4	0.9
DOMESTIC - GSRV	-1.1	3.8	-0.3	1.3
IMPORTED - AGR	-2.9	10.5	-2.9	0.2
IMPORTED - FOOD	-9.3	3.2	-9.3	-6.3
IMPORTED - CON	-11.0	1.3	-11.0	-8.1
IMPORTED - PETR	-7.6	5.2	-7.6	-4.6
IMPORTED - CHEM	-4.1	9.2	-4.1	-1.0
IMPORTED - MAN	-6.7	6.2	-6.7	-3.7
IMPORTED - PSRV	0.0	13.8	0.0	3.2
IMPORTED - GSRV	-1.6	12.0	-1.6	1.6
COMPOSITE - AGR	-0.9	12.5	2.1	2.0
COMPOSITE - FOOD	-2.5	8.2	-0.6	0.2
COMPOSITE - CON	-6.3	4.0	-5.3	-3.5
COMPOSITE - PETR	-8.9	3.7	-8.4	-5.9
COMPOSITE - CHEM	-4.1	8.0	-2.7	-1.1
COMPOSITE - MAN	-6.0	5.7	-5.2	-3.1
COMPOSITE - CONS	-4.5	5.5	-2.6	-1.6
COMPOSITE - PSRV	-1.4	6.7	0.3	1.1
COMPOSITE - GSRV	-1.2	4.1	-0.3	1.3
EXPORTED - AGR	-0.2	13.0	0.6	2.9
EXPORTED - FOOD	-0.4	12.5	0.1	2.7
EXPORTED - CON	-0.4	12.1	-0.2	2.7
EXPORTED - PETR	-1.2	11.8	-1.3	1.9
EXPORTED - CHEM	-0.1	12.9	-0.1	3.0
EXPORTED - MAN	0.5	12.9	-0.1	3.6
EXPORTED - PSRV	-0.5	11.2	-0.5	2.5
EXPORTED - GSRV	-1.5	10.7	-0.2	2.6

ratios, show larger than expected declines in their import prices due to the high elasticities of substitution. The reductions in import prices in experiments E2 and E4 are offset by an equal amount of devaluation. For PSRV, which faces no tariff charges the import price goes up by the exact amount of the devaluation. Notice however that unlike E2, the devaluation in E4 is not high enough to fully offset the decline in import prices of those sectors with the highest tariff rates.

The effect of trade liberalisation on activity and commodity prices does not easily fit into the dependent economy type results. This is because our aggregations do not conform to the tradability associated with such models. However, it is clear that the effect of trade policy on the cost of production determine the changes in activity (gross) prices. For instance, in experiment E1 tariff reductions lead to lower composite prices and hence lower prices of intermediate inputs. Together with lower wage costs, this lowers activity prices. The decline in activity prices are however moderated by devaluations in those experiments with flexible exchange rate regimes. In E2 the impact of tariff reforms are fully offset by devaluation. Notice however that in E3 and E4 those sectors which use a high proportion of imported intermediates; notably CON, PETR, CHEM and MAN have lower activity prices. On the other hand, the prices of AGR, FOOD, PSRV and GSRV do not reflect the changes in intermediate prices because they are low users of imported intermediates. Higher prices of these goods are mainly a result of higher labour costs.

Changes in domestic prices are closely related to the changes in activity prices. However, by reducing the domestic demand for the import competing goods, tariff reduction induces further decline in the domestic prices of these goods. This is true in most cases for CON, PETR and CHEM. In most experiments the lower prices of MAN and CONS are due to lower capital goods prices arising from a decline in investment demand.

Notice that because of the assumption of production differentiation between domestic output and imports, and between domestic consumption and exports, their prices diverge. As predicted activity prices, being the average sales prices, lie between domestic and export prices. Similarly, composite prices lie between imported and domestic prices. In traditional models domestic and world prices would differ only by the amount of trade taxes.

The effects of trade reform on quantities are shown in Table 6.4. To begin with, we examine the effect of tariff reductions on commodity imports. Notice that for E2, despite the multiplier effects, devaluation moderates the increase in import demand. The high import prices of PSRV and GSRV associated with the devaluation, actually reduce imports of these commodities. All imports are positive and high in E3 because they are financed by foreign savings. The lower import demands of CHEM and MAN in E1 and E4 are a result of the lower aggregate demand generated by the policy change.

The changes in gross output mirror the change in sectoral employment as shown in Table 6.2. In all the experiments those sectors with increasing levels of employment, namely, AGR, FOOD, PETR, PSRV and GSRV show increases in gross output; while those with

TABLE 6.4

Percentages Changes (from Base Values) in Activity and Commodity Quantities due to 50% Tariff Reduction

	E1	E2	E3	E4
ACTIVITY - AGR	0.0	0.85	0.10	0.09
ACTIVITY - FOOD	0.17	1.14	-0.22	0.17
ACTIVITY - CON	-0.63	2.46	-0.66	-0.43
ACTIVITY - PETR	4.02	6.84	4.54	4.29
ACTIVITY - CHEM	-0.11	2.54	0.34	0.16
ACTIVITY - MAN	-3.57	1.78	-0.47	-2.76
ACTIVITY - CONS	-6.74	0.23	0.07	-5.55
ACTIVITY - PSRV	0.58	2.62	0.89	0.69
ACTIVITY - GSRV	1.21	0.42	0.16	0.14
DOMESTIC - AGR	-0.12	0.79	0.41	-0.04
DOMESTIC - FOOD	0.03	0.83	-0.23	0.00
DOMESTIC - CON	-1.03	1.78	-0.93	-0.87
DOMESTIC - PETR	3.05	5.89	3.69	3.33
DOMESTIC - CHEM	-0.39	2.17	0.23	-0.13
DOMESTIC - MAN	-3.71	1.60	-0.55	-2.90
DOMESTIC - CONS	-6.74	0.23	0.07	-5.55
DOMESTIC - PSRV	0.51	2.30	0.94	0.58
DOMESTIC - GSRV	1.21	0.42	0.16	0.14
IMPORTED - AGR	4.12	4.59	11.34	3.66
IMPORTED - FOOD	12.23	8.74	15.47	11.47
IMPORTED - CON	10.43	7.72	12.92	9.93
IMPORTED - PETR	0.79	3.49	2.18	1.06
IMPORTED - CHEM	-0.38	0.96	1.85	-0.24
IMPORTED - MAN	-2.67	1.02	1.89	-1.94
IMPORTED - PSRV	-0.28	-1.27	1.13	-0.53
IMPORTED - GSRV	1.43	-3.33	0.81	-0.01
COMPOSITE - AGR	-0.01	0.88	0.67	0.05
COMPOSITE - FOOD	0.76	1.31	0.70	0.68
COMPOSITE - CON	2.15	3.45	2.90	2.14
COMPOSITE - PETR	1.73	4.49	2.81	2.00
COMPOSITE - CHEM	-0.39	1.66	0.90	-0.18
COMPOSITE - MAN	-3.14	1.28	0.79	-2.37
COMPOSITE - CONS	-6.74	0.23	0.07	0.60
COMPOSITE - PSRV	0.44	1.96	0.96	0.48
COMPOSITE - GSRV	1.21	0.28	0.18	0.13
EXPORTED - AGR	0.34	1.06	-0.86	0.52
EXPORTED - FOOD	1.26	3.53	-0.20	1.49
EXPORTED - CON	1.93	6.80	1.09	2.35
EXPORTED - PETR	5.66	8.45	5.99	5.93
EXPORTED - CHEM	0.61	3.50	0.62	0.90
EXPORTED - MAN	-2.30	3.42	0.26	-1.49
EXPORTED - PSRV	0.78	3.53	0.73	0.98
EXPORTED - GSRV	1.08	2.08	0.17	0.50

declining employment, CON, CHEM, MAN and CONS show declining output. As discussed above these output changes are reflections of the changes in the cost structure. It is clear from these results that tariff reductions will stimulate the growth of the export oriented sectors and those which rely heavily on imported intermediates.

The demand for domestic goods depends on relative prices and the elasticity of substitution between domestic and imported commodities. While a lower aggregate demand in E1, E3 and E4 depresses the demand for domestic goods; the increase in import demand through lower relative prices plays a major role. Notice, for example, that because of high elasticity of substitution increase in import demand is highest for AGR, FOOD and CON. On the other hand, the domestic demand for these goods is either declining or low. On the other hand, low substitutability between domestic and imported PETR, PSRV and GSRV holds up the domestic demand for these goods. The decline in aggregate investment demand explains the lower domestic demand for MAN and CONS. The Keynesian multiplier effect in E2 increases the demand and gross output of all commodities.

The response of export supply to trade liberalisation is quite straightforward. In experiments E1 and E3 the decline in domestic prices of exports leads to an improved competitiveness and therefore increased quantity of exports. Exceptions are the price increases of MAN in E1 and AGR and FOOD in E3 which reduce the volume of exports of these commodities. For experiments E2 and E4 devaluation increases the domestic currency price of exports and hence export quantities. It is therefore clear, as concluded earlier using aggregate results, that tariff reductions improve Kenya's export performance.

We now summarise the effects of the trade policy simulations on the Kenyan economy. To start with, trade liberalisation does not generate high economic growth in all the experiments. In the case of the neoclassical closure this is explained by the fact that the stimulative effect of the demand side are not allowed. However, the low GDP growth associated with the Keynesian closures, especially E1 which we have argued best represents the Kenyan economy, is particularly striking. It appears that with investments specified to adjust to available savings and with foreign borrowing constraints, tariff reductions will depress the economy. The low gains from trade liberalisation however would seem to be in line with those normally obtained from traditional models. In models of developed countries gains from trade liberalisation are usually less than 1% of GDP. These results are usually justified by the argument that tariffs in such countries are relatively low. Since the base tariff rates in our SAM data are low, a similar argument could be used to explain the low gains from liberalisation in our model. However, the original SAM data understates the tariff rates and therefore the gains from trade liberalisation are understated. The assumptions of product differentiation in our model provide another possible explaination for the lower effect of policy change on GNP. As it was argued earlier, the use of the Armington and CET functions by reducing the link between domestic and world prices reduces the domestic price response to policy change; and therefore understates the gains from the policy change. Furthermore, the simulations do not take into account the role of quantitative restrictions which have been found in some studies to account for large changes in growth of GDP.

The tariff reforms by reducing consumer prices lead to higher consumption. In the savings driven experiments consumption increases at the expense of investments and therefore depresses the economy. For the experiments with exogenous investments (E2 and E3) the increase in demand stimulates some economic growth. The two results underline the importance of the choice of investments-savings closure in CGE models. Since there is no agreed explanation of investment behaviour in LDCs the controversy about the choice of the closure continues. While most studies assume exogenous investments for short-run models, we have argued that this assumption may not be realistic for economies faced with external shocks. For this reason we report the results of the two closures throughout.

On the whole, trade liberalisation worsens both the balance of trade and the current account deficits. This should be expected given that lower tariffs encourage increased imports. However, the policy change by lowering the cost of production also stimulates export growth. But it is only in those cases where the current account is exogenously fixed that the export growth comes close to closing the balance of trade deficits.

At the sectoral level, it is shown that the exportable sectors and those using a high proportion of imported intermediates are stimulated. This leads to higher employment and profitability in these sectors. On the other hand the more highly protected sectors contract. In this sense it can be argued that in general trade liberalisation stimulates export oriented sectors at the expense of the protected sectors.

6.3 Devaluation and Subsidies

In this section we examine the implications of the use of devaluation and export subsidies as trade policy instruments. These policies are used for export promotion; and additionally in the case of devaluation for stabilisation. Their effects on the economy however go beyond the usual intended purposes. While there is a consensus about the consequences of export subsidies, the debate on the macroeconomic effects of devaluation is fraught with controversy.

Under the IMF-World Bank supported economic liberalisation programmes, the common recommendation for devaluation is premised on its efficiency as a policy tool for stabilisation and export promotion purposes. The basis of such recommendations follow from the traditional models of devaluation. In these models, typified by the dependent economy model, the effectiveness of devaluation lies in its expenditure reduction and switching effects. A discussion of the effectiveness and critique of devaluation is provided in Chapter 3. This discussion can be summarised as follows; by changing relative prices, for example increasing prices of traded relative to non-traded goods, devaluation increases production of export and reduces import demand. This results in internal and external balance. On the other hand, the structuralist argie that the income effects of devaluation in LDCs are larger than the substitution effects and therefore lead to reduction in output. In what follows we examine the effects of devaluation on the Kenyan economy.

To determine the effects of devaluation two simulations involving a 20% devaluation are run. The two experiments differ by the specification of the savings investment closure. E5 is savings driven while E6 is investments driven. Foreign capital inflows are also exogenously fixed in E5 thus minimising their role in financing investments.

The macroeconomic effects of the policy change are shown in Table 6.5. As expected devaluation leads to higher domestic prices. However, contrary to the predictions of the structuralist models, the policy change does not result in lower output. In both experiments the growth of GDP, although low, is positive. This result can be explained by the size of export demand elasticities (η) used in this study. Taylor (1983) and Ahluwalia and Lysy (1981) show that devaluation will have contractionary effects when export elasticities are low (normally below 0.5). To understand why our results differ from those predicted by structuralists we first note that increase in consumer prices reduces household and government consumption. With high η, the increase in export earnings due to devaluation more than offsets the decline in consumption; resulting in higher GDP. At lower η, the increase in export earnings would not be enough to offset the depressive effects of lower consumption.

It is clear that the investments-savings closure determine GDP growth rates and the price levels in the two experiments. With investment exogenously fixed in E6, the increase in savings associated with lower consumption has little effect in stimulating the economy. To the contrary the increased levels of employment contribute to the relatively higher GDP in E5. This growth is attributable to the usual

TABLE 6.5

Percentage Change in Macroeconomic Aggregates Due to 20% Devaluation

	E5	E6
(A) Prices		
GDP at Factor Cost	12.9	9.6
GDP at Market Price	13.5	10.3
Exports	18.1	17.6
Imports	20.0	20.00
Rural Household - CPI	15.8	11.8
Urban Household - CPI	13.5	10.4
Government - CPI	7.2	5.7
Investments	16.8	13.7
Unskilled Labour	17.8	13.3
Skilled Labour Wage	0.00	0.00
(B) Values		
Balance of Trade	-32.83	226.03
Balance of Payments	20.00	-49.32
Terms of Trade	-7.80	-9.80
(C) Quantities		
GDP at Factor Cost	1.56	0.83
GDP at Market Prices	1.61	0.60
Exports	3.44	4.01
Imports	2.54	-2.98
Rural Household Consumption	-0.08	-0.19
Urban Household Consumption	-2.10	-2.45
Government Consumption	-6.75	-5.43
Investments	15.14	0.00
Unskilled Labour	0.00	0.00
Skilled Labour	5.65	3.01

Keynesian effects. For example, the increase in price level lowers the real wage of skilled labour leading to 5.65% increases in employment in this labour group. The 17.8% increase in the wage unskilled labour implies a general increase in demand for aggregate labour.

Using the level of consumption as a measure of welfare, it is clear that devaluation reduces the household's welfare. The higher decline of urban household's consumption is a result of the fact that they consume a larger share of imported goods. This phenomenon explains why the urban sectors are normally the strongest pressure group against devaluation in LDCs.

Devaluation increases the volume of exports in both experiments. However, in E5 increased exports does not offset the rise in imports and hence does not improve the balance of trade. On the other hand, the rise in domestic prices of imports in E6 (together with lower aggregate demand) lowers the volume of imports and thus improves the balance of trade. With the current account exogenously fixed in E5 the balance of payments deficit rises by the amount of the devaluation. On the other hand, the balance of payments position improves by 49.32% in E6 because of lower imports.

The sectoral returns to factors and changes in employment levels are shown in Table 6.6. On the whole the policy change increases employment in all the sectors. The exception is government employment which declines because of lower government consumption. The increase in demand for investments in E5 leads to the high employment in MAN and CONS sectors. It is clear that the increase in demand for labour increases wage rates in all the sectors. Returns to capital follow the predictions of the sector-specific model. Higher employment leads to increased profitability in each sector. The factorial income distribution arising from devaluation is therefore favourable to unskilled labour and capital (except government capital). However, with the skilled wage fixed in nominal terms, it will have fallen in real terms with the rise in prices.

TABLE 6.6

Percentage Change in Factor Prices and Employment Due to 20% Devaluation

(A) Factor Prices	E5	E6
Wage - AGR	17.4	13.0
Wage - FOOD	6.4	4.9
Wage - CON	7.7	5.8
Wage - PETR	5.1	3.8
Wage - CHEM	4.2	3.1
Wage - MAN	5.8	4.3
Wage - CONS	6.4	4.8
Wage - PSRV	6.9	5.2
Wage - GSRV	3.5	2.7
Capital - AGR	20.1	15.7
Capital - FOOD	10.3	10.3
Capital - CON	17.7	14.8
Capital - PETR	24.6	17.1
Capital - CHEM	29.1	21.7
Capital - MAN	29.9	9.7
Capital - CONS	41.9	7.2
Capital - PSRV	15.0	11.1
Capital - GSRV	-8.30	-6.8
(B) Employment		
Employment - AGR	1.74	1.77
Employment - FOOD	2.68	3.88
Employment - CON	6.91	6.37
Employment - PETR	13.67	9.41
Employment - CHEM	11.35	8.64
Employment - MAN	15.45	3.58
Employment - CONS	15.52	1.16
Employment - PSRV	4.47	3.35
Employment - GSRV	-5.89	-4.75

Table 6.7 shows the changes in activity and commodity prices. The price changes are quite predictable. Devaluation increases import prices which, through increased composite prices, lead to higher intermediate inputs costs. Together with increased factor prices the higher intermediate prices lead to higher activity prices. The increase in domestic prices reflect not only the high costs of production, but also the pass through of the higher import prices into the domestic markets. Since export and import prices are denominated

TABLE 6.7

Percentage Change in Activity and Commodity Prices Due to 20% Devaluation

	E5	E6
ACTIVITY - AGR	17.9	13.67
ACTIVITY - FOOD	14.7	11.36
ACTIVITY - CON	14.3	11.82
ACTIVITY - PETR	19.5	18.21
ACTIVITY - CHEM	17.5	13.97
ACTIVITY - MAN	16.3	12.50
ACTIVITY - CONS	15.3	11.75
ACTIVITY - PSRV	11.8	9.18
ACTIVITY - GSRV	6.9	5.34
DOMESTIC - AGR	17.7	12.45
DOMESTIC - FOOD	14.2	10.53
DOMESTIC - CON	13.6	10.88
DOMESTIC - PETR	19.9	17.65
DOMESTIC - CHEM	16.9	12.03
DOMESTIC - MAN	16.2	11.80
DOMESTIC - CONS	15.3	11.75
DOMESTIC - PSRV	10.0	6.43
DOMESTIC - GSRV	6.8	5.26
IMPORTED - AGR	20.0	20.00
IMPORTED - FOOD	20.0	20.00
IMPORTED - CON	20.0	20.00
IMPORTED - PETR	20.0	20.00
IMPORTED - CHEM	20.0	20.00
IMPORTED - MAN	20.0	20.00
IMPORTED - PSRV	20.0	20.00
IMPORTED - GSRV	20.0	20.00
EXPORTED - AGR	18.7	17.19
EXPORTED - FOOD	18.6	17.73
EXPORTED - CON	18.2	17.91
EXPORTED - PETR	19.0	19.19
EXPORTED - CHEM	18.9	18.90
EXPORTED - MAN	17.6	19.04
EXPORTED - PSRV	17.0	17.06
EXPORTED - GSRV	23.8	21.88

in domestic currency values they should stimulate increased production for export and a decline in imports.

The effects of the policy change on quantities shown in Table 6.8. In general devaluation reduces the volume of import,

TABLE 6.8

Percentage Change in Activity and Commodity Quantities Due to 20% Devaluation

	E5	E6
ACTIVITY - AGR	1.22	1.24
ACTIVITY - FOOD	1.08	1.55
ACTIVITY - CON	4.32	3.99
ACTIVITY - PETR	4.09	2.87
ACTIVITY - CHEM	4.04	3.12
ACTIVITY - MAN	9.26	2.22
ACTIVITY - CONS	12.83	0.98
ACTIVITY - PSRV	2.65	1.99
ACTIVITY - GSRV	-5.84	-4.70
DOMESTIC - AGR	1.07	0.45
DOMESTIC - FOOD	0.75	0.99
DOMESTIC - CON	3.91	3.33
DOMESTIC - PETR	4.16	2.75
DOMESTIC - CHEM	3.92	2.68
DOMESTIC - MAN	9.23	2.06
DOMESTIC - CONS	12.83	0.98
DOMESTIC - PSRV	2.24	1.35
DOMESTIC - GSRV	-5.86	-4.72
IMPORTED - AGR	-2.79	-11.79
IMPORTED - FOOD	-6.41	-10.73
IMPORTED - CON	-4.24	-8.23
IMPORTED - PETR	4.07	1.42
IMPORTED - CHEM	2.14	-1.87
IMPORTED - MAN	6.94	-2.60
IMPORTED - PSRV	-2.10	-4.56
IMPORTED - GSRV	-11.19	-10.76
EXPORTED - AGR	1.69	3.61
EXPORTED - FOOD	3.62	5.89
EXPORTED - CON	7.02	8.21
EXPORTED - PETR	3.97	3.08
EXPORTED - CHEM	4.35	4.22
EXPORTED - MAN	9.56	3.67
EXPORTED - PSRV	3.82	3.79
EXPORTED - GSRV	-2.32	-1.16

although imports of PETR, CHEM and MAN remain positive in E5. The increases in the imports of these commodities, especially MAN, is due to the higher aggregate demand in E5; and in particular the increase in aggregate investment. The increase in real gross output reflects the changes in sectoral employment. The increase in the domestic currency price of exports increases the volume of exports in both simulations. It is also clear that the higher domestic demand is met by increased consumption of domestic output.

To summarise, devaluation of domestic currency leads to higher prices, but because of high export demand elasticities does not induce contraction of the economy. The policy leads to higher employment and profitability and therefore real gross output rises. The higher prices reduce household and government consumption. This in turn leads to higher savings and therefore contribute to increased investments. The effect of the policy change on the balance of trade and the balance of payments depends on the macroclosure and the resulting implication on aggregate demand. In the case of an investment driven model E5, devaluation increases aggregate demand. This results in higher import demand and therefore deficits in both the balance of trade and payments. The opposite result applies in the savings driven model E6. That is, lower aggregate demand leads to lower imports and hence improvement in both external accounts.

At the sectoral level higher prices reduce the volume of imports and increase exports. In both experiments higher employment levels increase gross output. It is also clear that by raising the relative prices of imports, devaluation encourages the substitution of domestic commodities for imports. However, as stated above it is only in E6 where the substitution effect is greater than the income effects, thus resulting in the balance of trade.

We now turn to the analysis of the effect of export subsidies. An export subsidy by lowering the foreign currency price of exports increases the competitiveness of domestic products. In practice, the use of subsidies in LDCs for trade policy purposes is fraught with difficulties. Firstly, LDCs who use subsidies to promote exports risk being subjected to countervailing duties in developed countries. Secondly, most LDCs face serious revenue constraints and therefore may not be able to provide subsidies sufficient to offset the anti-export bias associated with other policies. Furthermore, some of these countries may be administratively constrained so that even the available subsidies may not be channelled to the most efficient users. In our experiments we shall only be concerned with the efficacy of subsidies. The political economy type issues just sketched will not be evaluated.

The effects of export subsidies are simulated by a 20 percent subsidy to all exports; or equivalently a 20 percent negative tax on exports. As in the previous case the results of the two investments-savings macroclosures are reported, where E7 and E8 are savings and investments driven models, respectively.

As shown in Table 6.9 the effect of the export subsidy is to reduce export prices by 3.6% and 3.0% in experiments E7 and E8, respectively. This stimulates production for export. A rise in employment is necessary to facilitate increased exports. This is reflected in the 5.38% and 8.70% increase in employment of skilled labour and the 17.0% and 23.4% increase in unskilled labour wage in the two experiments. The high labour costs contribute to the higher GDP deflators at factor cost.

Export subsidies, by increasing export earnings, increases the households' real incomes. This increases real consumption by

TABLE 6.9

Percentage Change in Macroeconomic Aggregates Due to 20% Export Subsidy

	E7	E8
(A) Prices		
GDP at Factor Cost	12.9	17.5
GDP at Market Price	3.7	8.2
Exports	-3.6	-3.0
Imports	0.00	0.00
Rural Household - CPI	8.7	14.2
Urban Household - CPI	3.7	7.9
Government - CPI	2.9	4.9
Investments	1.0	5.2
Unskilled Labour	17.0	23.4
Skilled Labour Wage	0.00	0.00
(B) Values		
Balance of Trade	166.66	-244.37
Balance of Payments	0.00	91.84
Terms of Trade	-18.616	-15.42
(C) Quantities		
GDP at Factor Cost	1.48	2.40
GDP at Market Prices	1.16	2.53
Exports	8.50	7.53
Imports	1.01	9.70
Rural Household Consumption	5.86	5.87
Urban Household Consumption	6.65	6.80
Government Consumption	-2.79	-4.68
Investments	-23.28	0.00
Unskilled Labour	0.00	0.00
Skilled Labour	5.38	8.70

between 6-7% by both households. The decline in government consumption arises from the diversion of funds to finance subsidies and higher consumer prices. With lower savings investments decline in E7. On the other hand, the increase in foreign savings associated with E8 finances the desired investments and hence explains the higher rise in GDP.

In E7, the current account is exogenously fixed and therefore balances; while the 8.50% increase in the volume of exports and the relatively small increase in imports lead to the 166.7% improvement in the balance of trade. To the contrary, the 9.7% increase in imports overshadows the 7.53% increase in exports and leads to deficits in both the balance of trade and the balance of payments in E8.

Table 6.10 shows the changes in factor rewards and employment arising from the policy change. The increase in demand for labour is reflected in the increase in employment in most of the sectors. The increase in wages in all the sectors is also a reflection of high labour demand. Notice that low investment demand in E7 accounts for the decline in employment in MAN and CONS sectors; while in decline in government consumption leads to lower employment in the public sector in both models. It is also clear that profitability in each sector depends on the level of employment. Higher investment in E8 accounts for the higher employment and factor payments.

The effect of export subsidies will be to reduce export prices. Where domestic and exported goods are assumed to be perfect substitutes, changes in domestic prices will be similar to those of exports. However, under imperfect substitutability this will not be the case; as domestic prices will be determined by the changes in aggregate demand arising from the policy change. In particular, changes in domestic prices will depend on the price elasticity of export demand, the elasticity of transformation and the share of exports in gross output in each sector.

TABLE 6.10

Percentage Change in Factor Prices and Employment Due to 20% Export Subsidy

(A) Factor Prices	E7	E8
Wage - AGR	16.6	22.9
Wage - FOOD	6.2	8.4
Wage - CON	7.3	10.0
Wage - PETR	4.9	6.6
Wage - CHEM	4.0	5.4
Wage - MAN	5.5	7.5
Wage - CONS	6.1	8.3
Wage - PSRV	6.6	9.0
Wage - GSRV	3.4	4.6
Capital - AGR	19.7	25.6
Capital - FOOD	18.9	18.1
Capital - CON	25.2	28.7
Capital - PETR	108.8	120.4
Capital - CHEM	23.7	33.5
Capital - MAN	-9.7	18.9
Capital - CONS	-32.3	10.1
Capital - PSRV	21.1	26.5
Capital - GSRV	-0.6	-2.9
(B) Employment		
Employment - AGR	1.95	1.63
Employment - FOOD	8.86	6.66
Employment - CON	12.26	12.45
Employment - PETR	67.63	72.41
Employment - CHEM	9.05	12.52
Employment - MAN	-9.83	7.26
Employment - CONS	-20.10	0.82
Employment - PSRV	7.91	9.31
Employment - GSRV	-1.96	-3.63

These expectations are confirmed in Tables 6.11 and 6.12. Export subsidies reduce the foreign currency price of exports and hence increase export demand. The high increases in the exports of FOOD, CON and PETR are not only a result of high demand elasticities, but also a result of the relatively high transformation elasticities which makes it easy to switch resources into production for export. The moderate response by the export oriented AGR and PSRV are a result of low demand and transformation elasticities, respectively.

TABLE 6.11

Percentage Change in Activity and Commodity Prices Due to 20% Export Subsidy

	E7	E8
ACTIVITY - AGR	16.0	22.02
ACTIVITY - FOOD	9.1	13.63
ACTIVITY - CON	5.0	8.26
ACTIVITY - PETR	0.5	2.42
ACTIVITY - CHEM	6.3	10.97
ACTIVITY - MAN	-0.4	5.05
ACTIVITY - CONS	-0.7	4.26
ACTIVITY - PSRV	7.5	11.22
ACTIVITY - GSRV	3.14	5.18
DOMESTIC - AGR	14.2	21.58
DOMESTIC - FOOD	7.6	12.58
DOMESTIC - CON	2.6	6.27
DOMESTIC - PETR	-10.5	-7.50
DOMESTIC - CHEM	-0.5	0.14
DOMESTIC - MAN	-3.2	3.14
DOMESTIC - CONS	-0.7	4.26
DOMESTIC - PSRV	3.4	8.42
DOMESTIC - GSRV	3.0	5.09
IMPORTED - AGR	0.00	0.00
IMPORTED - FOOD	0.00	0.00
IMPORTED - CON	0.00	0.00
IMPORTED - PETR	0.00	0.00
IMPORTED - CHEM	0.00	0.00
IMPORTED - MAN	0.00	0.00
IMPORTED - PSRV	0.00	0.00
IMPORTED - GSRV	0.00	0.00
EXPORTED - AGR	-3.1	-1.30
EXPORTED - FOOD	-3.6	-2.57
EXPORTED - CON	-3.8	-3.41
EXPORTED - PETR	-4.3	-4.37
EXPORTED - CHEM	-1.5	-1.53
EXPORTED - MAN	0.2	-1.81
EXPORTED - PSRV	-4.6	-4.59
EXPORTED - GSRV	-2.82	-0.65

TABLE 6.12

Percentage Change in Activity and Commodity Quantities Due to 20% Export Subsidy

	E7	E8
ACTIVITY - AGR	1.37	1.15
ACTIVITY - FOOD	3.50	2.65
ACTIVITY - CON	7.58	7.70
ACTIVITY - PETR	16.73	17.65
ACTIVITY - CHEM	3.27	4.43
ACTIVITY - MAN	-6.30	4.45
ACTIVITY - CONS	-17.55	0.69
ACTIVITY - PSRV	4.65	5.44
ACTIVITY - GSRV	-1.94	-3.60
DOMESTIC - AGR	0.23	0.87
DOMESTIC - FOOD	2.41	1.92
DOMESTIC - CON	5.69	6.21
DOMESTIC - PETR	13.37	14.69
DOMESTIC - CHEM	1.59	3.27
DOMESTIC - MAN	-6.97	3.97
DOMESTIC - CONS	-17.55	0.69
DOMESTIC - PSRV	3.64	4.77
DOMESTIC - GSRV	-1.96	-3.62
IMPORTED - AGR	30.79	49.11
IMPORTED - FOOD	14.23	21.71
IMPORTED - CON	9.82	16.36
IMPORTED - PETR	5.32	8.94
IMPORTED - CHEM	1.27	7.42
IMPORTED - MAN	-8.98	6.11
IMPORTED - PSRV	-5.40	9.09
IMPORTED - GSRV	-0.51	-1.20
EXPORTED - AGR	4.77	1.99
EXPORTED - FOOD	11.55	8.13
EXPORTED - CON	19.06	16.88
EXPORTED - PETR	21.91	22.28
EXPORTED - CHEM	7.13	7.17
EXPORTED - MAN	-0.78	8.59
EXPORTED - PSRV	7.38	7.30
EXPORTED - GSRV	2.17	0.49

The effect of increased exports is to reduce the supply of gross output to the domestic market. This leads to an excess demand of the affected commodities. The excess demand is cleared through higher domestic prices (Table 6.1) and increased imports (Table 6.2). Notice that for exogeneously fixed investment in E8, aggregate demand is higher hence the price and quantity effects of the policy change are magnified.

Higher domestic prices also translate into higher activity prices. This encourages domestic production, especially in E8. As is the case in other experiments with endogenously determined investments, the lower output of MAN and CONS in E7 is a result of lower investments. Export subsidies, by reducing the government budget, also reduce the production and domestic consumption of GSRV.

To summarise, export subsidies generate more favourable results compared to devaluation. Subsidies lead to higher GDP, employment, profitability and exports. More importantly, household consumption increases with subsidies. In this sense this policy improves household welfare compared to devaluation. It would therefore appear that where appropriate export subsidies should be favoured over devaluation as a trade policy instrument. In practise however, especially in LDCs, revenue constraints limit the use of subsidies for export promotion.

6.4 Quantitative Restrictions

Up to this point simulations have been done with the assumption that prices clear the product markets. However, it was shown in Chapter 2 that quantitative restrictions (QRs) have been important trade policy instruments in Kenya. It was argued that QRs have been used not only as a means of protecting domestic industry but also for balance of payments purposes. It was also shown that one of the goals of the trade liberalisation program began in 1980 has been the reduction and eventual elimination of QRs. In this Section we simulate the economic effects of QRs.

In empirical models of QRs, two types of import controls are normally distinguished; quantity and premium rationing. In the former importers acquire product-specific licenses which cannot be resold. The later system assumes existence of a market for licenses so that quota holders can resell their licenses at a premium. This system leads to unproductive rent seeking behaviour. Quantity rationing, on the other hand, does not encourage rent seeking. It is assumed that the quota holders earn some rent only in so far as the price of their imports (inclusive of tariffs) is below what they are willing to pay (that is, the market clearing price at a given quota). Since there have not been cases of official or unofficial markets for quotas in Kenya we confine ourselves to this case.

Dervis et al. (1982) is one of the first studies to model the welfare effects of QRs. As discussed in Chapter 3, Grais et al. (1986) found that removal of QRs resulted in large gains in real GNP. Condon et al. (1984) arrived at similar results. Using Kenyan data, Gunning (1979) simulated the effect of QRs by increasing imports of non-food manufactures by 30% in a twelve sector model. He found that trade liberalisation reduced the profitability of the industrial sector. It also lowered domestic savings and favoured rural households at the expense of urban households.

To simulate the effects of QRs, imports are firstly exogenously fixed at their base values; and then the specification RENT of HERCULES is used to model changes in QRs in the presence of rents. It should be stressed that, unlike Grais et al. and Condon et al., we are not modelling rent seeking activities. Our model is akin to those of Levy (1987) and Gunning (1979). Models which incorporate rent seeking activities use estimated premiums to simulate the effects of QRs. In our model the deviations of imports from their base values, are used as a proxy for changes in import controls.

The cell accounts of the SAM associated with the specification rent collects the rent arising from quota rationing. We assume that quotas are only binding in five sectors: FOOD, CON, PETR, CHEM and MAN. We also assume that the rents accrue only to companies and are therefore paid to company income accounts in the SAM. This specification will affect income distribution and hence will have consumption and investment consequences. For instance, changes in the value of rents will directly affect company savings, and its income transfers to the other institutions and ROW.

This specification is also used to model the consequences of import compression. Although this phenomenon has not always been considered as a policy instrument it is widely used by LDCs facing balance of payments problems. Helleiner (1986), Khan and Knight (1988), and Besley and Collier (1989) have demonstrated that import compression can have serious negative effects on LDC economies. These include lower economic growth, higher unemployment and poor export performance. The problems arise especially where imports consist mainly of intermediate inputs. For example, import compression increases the rent inclusive price of imports and hence composite prices. This in turn increases intermediate costs and therefore lowers output. The opposite effect arises where import controls are relaxed.

To simulate effects of the changes in import controls two experiments are run involving a 5 percent increase and reduction of imports (E9 and E10), respectively. They respectively represent reduction in QRs and import compression. Table 6.13 shows the macroeconomic results of the two experiments. As noted above changes in import quantities affect domestic prices through changes in intermediate prices. This is especially evident in the changes of GDP deflators. In E9 an increase in import quotas reduces domestic prices. However, this only leads to a small increase in the overall growth of GDP. This can be explained in several ways. Firstly, an increase in imports reduces rents by K£94.11m. Since rent is part of value added this contributes to a depressed GDP growth. Secondly, the effect of aggregate demand on the growth of GDP is minimised by the decline in investment demand. It is however notable that lower consumer prices raise household and government consumption. Urban households however benefit more than rural household from the policy change because they consume a higher proportion of imported goods. The increase in government consumption also benefit mostly the urban households. Overall, the policy improves the welfare of urban households relative to rural households.

The consequences of experiment E9 are clearly opposite to those of E10. The aggregate price level and consumer prices rise thus reducing aggregate demand. Notice however that urban household consumption declines the most with import compression. Lower consumption leads to increased savings and hence higher investment levels. Despite the increased rents and investment demand, lower aggregate demand depresses economic growth. The decline in the

TABLE 6.13

Percentage Change in Macroeconomic Aggregates Due to 5% Changes in Imports Quotas

(A) Prices	E9	E10
GDP at Factor Cost	-11.0	12.3
GDP at Market Price	-10.5	12.2
Exports	-1.6	1.8
Imports	0.0	0.0
Rural Household - CPI	-7.9	8.3
Urban Household - CPI	-10.2	11.6
Government - CPI	-4.1	4.9
Investments	-19.3	23.5
Unskilled Labour	-3.0	1.5
Skilled Labour	0.0	0.0
(B) Values		
Balance of Trade	-39.33	31.63
Balance of Payments	0.0	0.0
Terms of Trade	-7.93	7.99
(C) Quantities		
GDP at Factor Cost	0.18	-0.61
GDP at Market Prices	0.17	-0.97
Exports	4.39	-4.66
Imports	3.63	-3.72
Rural Household Consumption	1.02	-1.44
Urban Household Consumption	4.02	-4.58
Government Consumption	4.26	-4.71
Investments	-11.99	8.56
Unskilled Labour	0.0	0.0
Skilled Labour	0.66	-2.20

employment of skilled labour also contributes to the decline in output.

The two experiments have different effects on trade aggregates. Lower export prices improve export performance in E9 while the opposite is true in E10. However, lower export prices also lead to a deterioration in the terms of trade in E9. It is clear that the relaxation of import controls leads to a trade deficit, while import compression improves the balance of trade. The improvement of the balance of trade in E10 shows the effectiveness of import controls in dealing with trade deficits. In both experiments foreign capital inflow is exogenously fixed hence the balance of payments accounts do not change.

The effect of the policy change on factor returns and employment are shown Table 6.14. Resource allocation arising from

TABLE 6.14

Percentage Changes in Factor Prices and Employment Due to 5% Change in Import Quotas

(A) Prices	E9	E10
Wage - AGR	-3.0	1.5
Wage - FOOD	-1.1	0.6
Wage - CON	-1.4	0.7
Wage - PETR	-0.9	0.5
Wage - CHEM	-0.7	0.4
Wage - MAN	-1.0	0.5
Wage - CONS	-1.1	0.6
Wage - PSRV	-1.2	0.6
Capital - AGR	-0.6	0.3
Capital - FOOD	-4.3	3.3
Capital - CON	3.2	-5.1
Capital - PETR	3.0	-6.3
Capital - CHEM	86.6	-48.3
Capital - MAN	-5.8	2.2
Capital - CONS	-13.4	9.3
Capital - PSRV	-26.5	21.0
Capital - GSRV	7.5	-8.6
(B) Employment		
Employment - AGR	-1.01	1.32
Employment - FOOD	3.31	-4.28
Employment - CON	3.28	-5.24
Employment - PETR	60.74	-39.26
Employment - CHEM	-2.58	0.91
Employment - MAN	-8.91	6.04
Employment - CONS	-13.81	9.69
Employment - PSRV	1.69	-3.18
Employment - GSRV	4.02	-4.54

increase in import quotas in E9 benefit those sectors, (PETR, CON and FOOD), which use imported intermediate inputs intensively; and also GSRV and PSRV. The declines in employment in MAN and CONS is linked to lower investment demand. Accordingly, profitability goes up for those sectors with increased employment and declines in those where unemployment increases. The pattern of factor returns and employment in E10 is the opposite to those of E9.

The implication of the policy changes on sectoral prices and quantities are shown in Tables 6.15 and 6.16. It is clear that changes in import quotas have a high effect on commodities prices. In E9 higher imports reduce domestic prices via increase in supply. The increase in intermediate inputs (and at lower prices) lead to higher gross output of FOOD, CON and PETR sectors. This explains the increase in employment in these sectors. On the other hand, the higher import competition reduces domestic demand and gross output of AGR. Lower investment demand results in lower output of MAN and CONS. However, the lower cost of production in E9, by reducing export prices, results in increased volume of exports.

As before, lower import quotas generate opposite results to those from higher quotas. Experiment E10 shows that lower imports lead to higher prices. This leads to lower output in the import dependent sectors; and higher output in the less dependent sector AGR, while the growth in MAN and CONS sectors is due to higher investments. Higher prices also reduce the volume of exports.

To summarise, it has been shown that in the presence of quota rationing, liberalisation in the form of quota increases does not lead to significant growth of GDP. This is because the policy reduces quota rents which are a component of GDP. The reduction in domestic prices associated with the increase in import supply encourages consumption. By lowering savings this reduces investment demand and hence contributes to lower economic growth. The increase in consumption however implies increased household welfare. The lower consumption of rural households reflects the fact that they consume a lower proportion of imported goods. It is also a result of lower

TABLE 6.15

Percentage Change in Activity and Commodity Prices
Due to 5% Change in Import Quotas

	E9	E10
ACTIVITY - AGR	-4.43	3.62
ACTIVITY - FOOD	-7.04	7.62
ACTIVITY - CON	-9.54	11.27
ACTIVITY - PETR	-20.75	29.32
ACTIVITY - CHEM	-12.54	15.40
ACTIVITY - MAN	-18.00	22.15
ACTIVITY - CONS	-15.85	20.79
ACTIVITY - PSRV	-5.77	6.85
ACTIVITY - GSRV	-4.23	5.13
DOMESTIC - AGR	-5.51	4.53
DOMESTIC - FOOD	-7.72	8.32
DOMESTIC - CON	-10.75	12.59
DOMESTIC - PETR	-30.46	57.43
DOMESTIC - CHEM	-17.37	21.02
DOMESTIC - MAN	-19.99	24.41
DOMESTIC - CONS	-15.85	20.79
DOMESTIC - PSRV	-7.28	8.48
DOMESTIC - GSRV	-4.23	5.12
EXPORTED - AGR	-1.19	0.78
EXPORTED - FOOD	-1.80	1.97
EXPORTED - CON	-1.81	2.20
EXPORTED - PETR	-4.14	5.42
EXPORTED - CHEM	-0.49	0.68
EXPORTED - MAN	0.19	0.29
EXPORTED - PSRV	-1.41	2.09
EXPORTED - GSRV	-4.86	6.02

TABLE 6.16

Percentage Change in Activity and Commodity Quantities Due to 5% Change in Import Quotas

	E13	E14
ACTIVITY - AGR	-0.71	0.93
ACTIVITY - FOOD	1.33	-1.78
ACTIVITY - CON	2.07	-3.38
ACTIVITY - PETR	15.35	-15.43
ACTIVITY - CHEM	-1.0	0.34
ACTIVITY - MAN	-5.70	3.71
ACTIVITY - CONS	-11.94	8.08
ACTIVITY - PSRV	1.01	-1.94
ACTIVITY - GSRV	3.97	-4.49
DOMESTIC - AGR	-1.55	1.59
DOMESTIC - FOOD	0.78	-1.30
DOMESTIC - CON	1.04	-2.51
DOMESTIC - PETR	11.65	-12.81
DOMESTIC - CHEM	-2.39	1.55
DOMESTIC - MAN	-6.28	4.19
DOMESTIC - CONS	-11.94	8.08
DOMESTIC - PSRV	0.60	-1.56
DOMESTIC - GSRV	3.98	-4.49
IMPORTED - AGR	-12.10	11.00
IMPORTED - FOOD	5.00	-5.00
IMPORTED - CON	5.00	-5.00
IMPORTED - PETR	5.00	-5.00
IMPORTED - CHEM	5.00	-5.00
IMPORTED - MAN	5.00	-5.00
IMPORTED - PSRV	-3.13	2.53
IMPORTED - GSRV	1.75	-2.08
EXPORTED - AGR	1.80	-1.16
EXPORTED - FOOD	5.59	-5.67
EXPORTED - CON	8.54	-9.34
EXPORTED - PETR	20.97	-21.13
EXPORTED - CHEM	2.25	-3.02
EXPORTED - MAN	-0.85	-1.28
EXPORTED - PSRV	2.16	-3.05
EXPORTED - GSRV	3.80	-4.29

income, as shown by the decline in the agricultural wage which mainly accrues to the rural sector.

Although import compression improves the balance of trade and terms of trade by reducing imports and increasing export prices; it results in poor export performance. Higher prices also reduce aggregate demand; which despite increased investment (due to higher savings and rents), lead to a decline in GDP. Import compression, by reducing imported intermediate inputs, also contribute to the decline in GDP. The gross output of the imported dependent sectors are the most affected.

6.5 Markup Pricing

Our model has so far only assumed that firms combine labour and capital in CES technology to form value added; which in turn combines with intermediate inputs in Leontief technology to form gross output. Under minimisation these assumptions imply that factors are paid their marginal products, so that prices are set equal to marginal cost. However, one of the features of the structuralist models is that firms do not follow the marginal cost pricing, but in fact use mark-up pricing rules in setting their prices. This assumption is justified by widespread existence of excess capacity and oligopolistic market structures in LDCs.

Under the mark-up pricing rule, gross output prices take the form:

$$PX_j = (1 + \tau_i)(\sum_i a_{ij}W_i + \sum_j a_{ji}P_j) \qquad (6.2)$$

where PX_i is the gross output price in sector i, τ_i is the mark-up rate, W_i is the wage rate and P_j is the intermediate (composite) price. The coefficients a_{ij} and a_{ji} are the labour-output and input-output ratios, respectively. The term $(\sum_i a_{ij}W_i + \sum_j a_{ji}P_j)$ is the average variable cost, while $\tau_i(\sum_i a_{ij}W_i + \sum_j a_{ji}P_j)$ is the return to capital in sector

i. It is therefore clear from (6.2) that returns to capital are mark-ups over the variable costs. In our model we assume that this mark-up rate is constant so that the change in gross output price will only depend on changes in labour and intermediate input costs.

Under the markup pricing rule capital is paid (profit rate) a fixed share of the total value of gross output. The technology underlying production with markups is such that capital and labour are no longer substitutable. It is therefore assumed that firms minimise production costs by combining labour and aggregate intermediate inputs in fixed proportions; where intermediate inputs are still aggregated in fixed coefficients. This technology means that the marginal cost of production is constant and supply will depend on average costs and aggregate demand.

We assume that the FOOD, CON, PETR, CHEM and MAN sectors follow the markup pricing rule, while the rest of the sectors use marginal cost pricing rules. The implication of markup pricing is examined by repeating the experiment involving a 20% subsidy on all exports. This experiment (E15) assumes exogenous investments, therefore its results are compared with those of E8 of the previous section.

As noted earlier, the initial effect of the export subsidy is to increase export demand. It is clear however from Tables 6.17-6.20 that the results of E15 differ from those of E8. Furthermore, the results for those sectors with markup pricing specification differ from those with marginal cost pricing. To explain these differences

TABLE 6.17

Percentage Change in Macroeconomic Aggregates With Mark-up Pricing

(A) Prices	E8	E15
GDP at Factor Cost	17.5	17.1
GDP at Market Price	8.2	7.5
Exports	-3.0	-4.0
Imports	0.00	0.0
Rural Household - CPI	14.2	14.5
Urban Household - CPI	7.9	7.6
Government - CPI	4.9	4.9
Investments	5.2	4.1
Unskilled Labour	23.4	25.1
Skilled Labour	0.00	0.00
(B) Values		
Balance of Trade	-244.37	-222.70
Balance of Payments	91.84	86.92
Terms of Trade	-15.42	-20.83
(C) Quantities		
GDP at Factor Cost	2.40	3.36
GDP at Market Prices	2.53	3.66
Exports	7.53	11.64
Imports	9.70	12.29
Rural Household Consumption	5.87	6.58
Urban Household Consumption	6.80	7.97
Government Consumption	-4.68	-4.57
Investments	0.00	0.0
Unskilled Labour	0.00	0.0
Skilled Labour	8.70	9.70

TABLE 6.18

Percentage Changes in Factor Prices and Employment With Mark-up Pricing

(A) Prices	E8	E15
Wage - AGR	22.9	24.5
Wage - FOOD	8.4	9.0
Wage - CON	10.0	10.7
Wage - PETR	6.6	7.1
Wage - CHEM	5.4	5.8
Wage - MAN	7.5	8.0
Wage - CONS	8.3	8.9
Wage - PSRV	9.0	9.7
Wage - GRSV	4.6	4.9
Capital - AGR	25.6	27.5
Capital - FOOD	18.1	0.00
Capital - CON	28.7	0.00
Capital - PETR	120.4	0.00
Capital - CHEM	33.5	0.00
Capital - MAN	18.9	0.00
Capital - CONS	10.1	12.6
Capital - PSRV	26.5	30.3
Capital - GSRV	-2.9	-2.20
(B) Employment		
Employment - AGR	1.63	1.79
Employment - FOOD	6.66	3.68
Employment - CON	12.45	13.52
Employment - PETR	72.41	43.81
Employment - CHEM	12.52	11.17
Employment - MAN	7.26	7.10
Employment - CONS	0.82	1.68
Employment - PSRV	9.31	10.88
Employment - GSRV	-3.63	-3.45

first note that under the markup pricing rule increased production is possible at constant marginal cost. However, in the marginal cost pricing case, marginal cost is an increasing function of output. Therefore in E15, the increase in demand for exports can be met without cost increases. This is shown in Table 6.19 where the change in activity prices in E15 are much lower than those of E8. Notice also that the activity prices of marginal cost pricing sectors are much higher than those of the markup pricing sectors. The relative differences in activity prices is reflected by the changes in gross

TABLE 6.19

Percentage Change in Activity and Commodity Prices with Mark-Up Pricing

	E8	E15
ACTIVITY - AGR	22.02	17.76
ACTIVITY - FOOD	13.63	8.43
ACTIVITY - CON	8.26	1.89
ACTIVITY - PETR	2.42	-9.19
ACTIVITY - CHEM	10.97	0.93
ACTIVITY - MAN	5.05	0.45
ACTIVITY - CONS	4.26	-1.66
ACTIVITY - PSRV	11.22	8.31
ACTIVITY - GSRV	5.18	3.11
DOMESTIC - AGR	21.58	16.43
DOMESTIC - FOOD	12.58	6.88
DOMESTIC - CON	6.27	-0.82
DOMESTIC - PETR	-7.50	-23.01
DOMESTIC - CHEM	0.14	-7.35
DOMESTIC - MAN	3.14	-2.26
DOMESTIC - CONS	4.26	-1.66
DOMESTIC - PSRV	8.42	4.63
DOMESTIC - GSRV	5.09	3.02
IMPORTED - AGR	0.00	0.00
IMPORTED - FOOD	0.00	0.00
IMPORTED - CON	0.00	0.00
IMPORTED - PETR	0.00	0.00
IMPORTED - CHEM	0.00	0.00
IMPORTED - MAN	0.00	0.00
IMPORTED - PSRV	0.00	0.00
IMPORTED - GSRV	0.00	0.00
EXPORTED - AGR	-1.3	-2.58
EXPORTED - FOOD	-2.57	-3.97
EXPORTED - CON	-3.41	-5.12
EXPORTED - PETR	-4.37	-8.60
EXPORTED - CHEM	-1.53	-2.89
EXPORTED - MAN	-1.81	0.12
EXPORTED - PSRV	-4.59	-4.93
EXPORTED - GSRV	-0.65	-2.85

TABLE 6.20

Percentage Change in Activity and Commodity Quantities with Mark-up Pricing

	E8	E15
ACTIVITY - AGR	1.15	1.26
ACTIVITY - FOOD	2.65	3.68
ACTIVITY - CON	7.70	13.52
ACTIVITY - PETR	17.65	43.81
ACTIVITY - CHEM	4.43	11.17
ACTIVITY - MAN	4.45	7.10
ACTIVITY - CONS	0.69	1.42
ACTIVITY - PSRV	5.44	6.33
ACTIVITY - GSRV	-3.60	-3.42
DOMESTIC - AGR	0.87	1.18
DOMESTIC - FOOD	1.92	2.95
DOMESTIC - CON	6.21	11.65
DOMESTIC - PETR	14.69	38.43
DOMESTIC - CHEM	3.27	9.28
DOMESTIC - MAN	3.97	6.54
DOMESTIC - CONS	0.69	1.42
DOMESTIC - PSRV	4.77	5.75
DOMESTIC - GSRV	-3.62	-3.43
IMPORTED - AGR	49.11	53.59
IMPORTED - FOOD	21.71	22.32
IMPORTED - CON	16.36	15.60
IMPORTED - PETR	8.94	18.29
IMPORTED - CHEM	7.42	7.16
IMPORTED - MAN	6.11	6.65
IMPORTED - PSRV	9.09	10.62
IMPORTED - GSRV	-1.20	-1.07
EXPORTED - AGR	1.99	1.51
EXPORTED - FOOD	8.13	9.22
EXPORTED - CON	16.88	24.98
EXPORTED - PETR	22.28	51.79
EXPORTED - CHEM	7.17	15.49
EXPORTED - MAN	8.59	11.90
EXPORTED - PSRV	7.30	7.95
EXPORTED - GSRV	0.49	0.66

output in Table 6.20; where the output is highest in the markup pricing sectors.

Notice also that given the increase in aggregate demand, the increase in exports implies relatively lower supply to the domestic market. This explains the large increases in sectoral imports in Table 6.20. As before, the high increases in imports is due to the high elasticities of substitution and transformation in AGR, FOOD, CON and PETR sectors. Higher imports also account for lower domestic prices in the import competing sectors.

Table 6.18 shows the changes in returns to factors and employment levels. Apart from the agricultural wage, there is little difference between the wage changes in E15 and E8. This is because with 98 percent of unskilled labour employed in the agricultural sector, the 25.1 percent increase is unskilled labour wage (Table 6.17) is almost fully reflected in the change in the sectors' wage. The higher returns to capital in those sectors without markup pricing reflects higher employment.

In conclusion, it has been shown that taking into account the alternative pricing rules affects trade policy results. In particular, modeling mark-up pricing rules generate higher real GDP growth, employment levels, household consumption and export performance compared to the marginal cost pricing model.

CHAPTER SEVEN

CONCLUSION

The object of this thesis has been to determine the impact of trade liberalisation on the Kenyan economy. The effects of tariff reduction, devaluation and export subsidies were simulated. In addition, the consequences of quantitative restrictions and markup pricing were simulated. To obtain the widest possible implication of the policy changes, the experiments have been run with alternative closure rules.

Although several policies are in practise simultaneously implemented we have made no attempt to simulate the effects of a combination of policies. This is primarily because our objective has not been to model actual policy changes. While it would be realistic to model such a process, the risk is that the generated results may be difficult to interpret. In other words, the model may turn out to be a "black box" in which it is difficult to determine what drives the model results. The advantage of the approach we have taken is that it provides a direct link between parameter changes and the model results. This minimises the ambiguity of the model results.

In all, fifteen experiments have been run. No attempt will be made to provide a summary and policy implications of all the results. We shall instead concentrate in providing the main results and conclusions.

The model results show that the gains from tariff reductions, in terms of GDP growth, are minimal. This is true for both neoclassical and Keynesian models. While these results are in line with those of the literature, they are explained by different factors. The small gains from tariff reductions, especially in developed economies, are normally argued to be due to low tariffs. Although the tariff rates are underestimated in our data it is unlikely that they are the major driving force behind our results. Quantitative restrictions and the assumption of product differentiation are some of the explanatory factors.

It is also shown that tariff reductions increase household consumption. However, this occurs at the expense of investments. Lower investment provides another explanation for lower growth of GDP. At the sectoral level, the policy change leads to increase in exports. But as expected it also induces contraction in the import-competing sectors.

The effect of the devaluation of domestic currency, as should be expected is inflationary. However, contrary to the structuralists predictions it does not lead to the contraction of the economy. This is explained by the high elasticities of export demand specified in our model. The policy change however reduces household consumption.

It turns out that the effect of devaluation on the balance of trade depends on the macroclosure. With endogenous investments, increase in savings due to lower consumption leads to increased investment. This increases import demand for investment goods and therefore contribute to a deterioration in the balance of trade. On the contrary, lower aggregate demand leads to lower imports and hence an improvement in the balance of trade when investment is exogenously fixed. As expected the policy change also improves export performance.

The effect of export subsidies are closely similar to those of devaluation. However, unlike devaluation they improve household welfare through higher consumption. By directly benefiting the export sectors they generate greater growth in these sectors and therefore higher employment and export volume. The effect of export subsidies are also less inflationary than devaluation.

The policy change involving quantitative restrictions has been modelled as changes in the volume of imports. While this may not be the best way of modelling quota restrictions the results are quite instructive. It is shown that the relaxation of quota restrictions does not contribute to higher GDP. This is because the policy change reduces rents which are part of GDP. It also leads to lower investment, through increased consumption, and therefore contributes to lower GDP.

Import compression, on the other hand, depress the economy. The inflationary nature of this policy not only reduces aggregate demand but also leads to higher cost of production. However, it improves the balance of trade. This therefore shows why import controls are widely used to deal with the balance of payments problems in LDCs; albeit at a high cost to the economy.

The model also shows that incorporating markup pricing rules generate different results from the marginal cost pricing rule. In particular, the model with markup pricing show higher real GDP, resource utilisation, aggregate consumption and export performance. The assumption of excess capacity allows increased output without any inflationary effects or deterioration in the external account.

The income distributional effects of policy changes are not straightforward in our model. To start with, the model only handles functional distribution of income. This means that the model results cannot be used to address the issue of income inequality associated with trade liberalisation. In most of our experiments unskilled labour gain from policy changes. However, with the Keynesian closure assumed in our model the growth of the economy is always at the expense of skilled labour. This is because increases in GDP results from increased employment which is only possible with lower real wages. Any redistribution of income towards unskilled labour will favour rural households since this factor is almost exclusively employed in agriculture. It should be noted also that since we assume sector-specific capital, the policy effects on the demand for aggregate labour will determine payments to capital. Capital will therefore gain from policies that induce greater employment through lower real wages of skilled labour.

The results of our model have to be interpreted with the weaknesses of CGE models in mind. It is clear that the model results depend on model closure and the assumed elasticities. This means that the model results reflect the assumptions about the structure of the economy. For this reason the generalisation of the results is limited.

The static nature of the model also limits the usefulness of the model in analysing structural adjustment problems which are dynamic in nature. This criticism also applies to the fact that the model only specifies the real side of the economy. Incorporating financial and monetary aspects to the model would facilitate a better understanding of the adjustment processes.

It can be concluded however that despite these weaknesses the model enables us to examine important aspects of trade liberalisation. The model results show clearly how the economy responds to policy changes. This characteristic of the model is important for policy formulation.

FOOTNOTES

CHAPTER TWO

1/ For a recent critique and alternatives to the traditional trade policies see Ocampo (1986) and Evans (1989).

2/ See Hirschman (1968) for analysis of the different phases of ISI policies.

3/ The seriousness of the economic problems facing LDCs sub-Saharan African countries is reflected by the concern the region has received from the World Bank and other donors. See for example, World Bank (1983, 1984, 1986, 1989a, 1989b).

4/ The mission however argued that this type of protection should be given only to selected industries and for short periods.

5/ See 1966/70 Development Plan, p.235.

6/ See 1970/74 Development Plan, p.320.

7/ The IBRD (1987) study is quoted in Sharpley and Lewis (1988).

8/ Kenya's first structural adjustment loan was approved in March 1980 and the second was approved in July 1982. Kenya has also benefitted from the sectoral-adjustment credits provided under the Special Facility for sub-Saharan Africa. A loan worth US $40m. to finance the agricultural sector was approved in June 1986.

9/ The IMF approved standby credits in 1979, 1980, 1982, 1983 and 1985. The first three standbys were cancelled before they expired because Kenya exceeded IMF ceilings. In February 1988 Kenya reached an agreement with the IMF for a loan worth SDR 175.2 million to be drawn in two stages. SDR 85m is to be drawn during the first 18 months under a stand-by agreement and the rest, SDR 90.2m, is to be drawn over three years (with SDR 28.4m available immediately) under the Structural Adjustment Facility.

10/ See Sessional Paper No.4, Kenya (1982).

11/ See Sessional Paper No.4, Kenya (1982).

12/ See Budget Speech of 1982/83.

13/ The Nominal Effective Exchange Rates (NEER) are calculated following Rhomberg (1976). Formally:

$$NEER_t = \sum_{j=1}^{7} (x_{kj}/\Sigma x_{kj})\ XR_{kj}$$

where:

X_{kj} = Kenya's exports to country j

$XR_{kj} = XR_j/XR_k$

and

XR_j = value of one unit of trading-partner j currency in terms the numeraire currency (the dollar)

XR_k = unit value of the dollar in terms of the Kenya shilling

XR_{kj} is expressed as an index number relative to the base period 1980. To obtain the real effective exchange rate index (REER), NEER is deflated by a trade weighted relative price.

$$REER_t = \frac{NEER_t}{TWP_t}$$

where $$TWP_t = \sum_{j=1}^{7} (x_{kj}/\Sigma x_{kj}) \frac{CPI_{kt}}{WPI_{jt}}$$

CPI_{kt} = Kenya's consumer price index at period t.

WPI_{jt} = country j's wholesale price index at period t.

CHAPTER THREE

1/ In both cases we are only confining ourselves to changes in real product wages. Changes in real consumption wage would be ambiguous because they depend on the weights of the workers' consumption basket of the two goods.

2/ To model product differentiation between exports and domestic demands de Melo and Robinson use a logistic supply curve discussed in Dervis et al. (1982, pp.228-230) instead of CET functions. de Melo and Robinson (1989) argue that the two specifications yield similar results for small changes around equilibrium.

CHAPTER FOUR

1/ See Kenya (1981)

2/ See Kenya (1979)

3/ An alternative method of reducing the SAM is that of apportionment introduced by Pyatt (1985, 1989).

4/ Column equation is $y_i = y_i(p, y; \theta, \Omega)$.

5/ It is this property that led Drud, Grais and Pyatt to refer to the model underlying (4.2) as being in transactions-value (TV) form.

CHAPTER FIVE

1/ Other parameters which can be endogenously determined but are normally exogenously set for policy experiments include taxes, exchange rates, and factor quantities.

2/ See Srinivasan and Whalley (1986) and Shoven and Whalley (1984) for a summary of these problems.

3/ See Taylor (1979) and Deaton and Muellbauer (1980) for a thorough discussion and derivation of LES parameters.

4/ Different types of models and closure rules are discussed below.

5/ Of course even when the number of equations and variables in the system have been equated Walras' Law implies one more equation (defining the numeraire) needs to be added to the system. Therefore 12 variables are actually fixed in the model.

6/ See Adelman and Robinson (1988), Lluch (1979) and Robinson (1989).

7/ Note that in both models 1 and 2 the real exchange rate is the relative price of tradeables and non-tradeables.

8/ See also Fallon (1985) and The World Bank (1983).

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APPENDIX

This appendix contains the HERCULES representation of our model. As explained before, HERCULES was developed for use in solving SAM-based CGE models. The system has its origin in Drud et al. (1986) and its application is described in detail in Drud and Kendrick (1986). In this section we provide a brief sketch of how our model has been defined, calibrated and then solved.

To start with lines 5-115 define the accounts of the SAM and the acronyms used in the model. The accounts are self-explanatory, but the acronyms require some explanation. The acronyms are abbreviations of key words used to specify the model. For example, MF defines market factors used in domestic production, NP is a price fixed as numeraire, CES defines CES production function and so on.

The SAM is defined in lines 116-281. Notice that the SAM is not square. This is because accounts with zero elements have been eliminated. This has no modelling implications since GAMs does not store zeros. However, it reduces the number of input lines and therefore makes the input file easier to read.

Lines 365-530 define the specification Table. This is exactly the SAM defined above but with the numerical cell elements replaced by acronyms. The acronyms here define a behavioural equation for each non-zero cell of the SAM and the derived behavioural (price) equation for household consumption and production (activity) accounts. Equations which are identities are also specified; for example, the cell equations where values are defined by multiplying prices with quantities and accounts with quantities only. Examples of such accounts are the consumption and commodity accounts, respectively.

The specification Table, by defining the behavioural equations in each cell, therefore forms the essence of TV-approach to modelling.

The determination of the values in each cell can be deduced from the column specification. For instance, in column six of row 367 Rural household consumption functions are specified in LES form between rows 375-383; in column three of row 386 the distribution of government income to domestic institutions is exogenously fixed in domestic currency (TEXO) in rows 387-390, but transfers to ROW are fixed in foreign currency (FEXO). The allocation of income to consumption and savings are however specified as residuals (UNSPEC). The rest of the specifications follow closely the model specified in Chapter Four.

The SAMs accounts are specified (in column TYPE) in the Account Table (row 283-363). For example, unskilled (ULBRD) and skilled labour (SLBRD) are defined as market factors and hence will have price and quantity; but domestic skilled labour (SLBRF) employed abroad are defined as non-market factor (NMF) and therefore will only have values. Similarly ACT define activity and commodity accounts and INST and INSTC define institutional income and consumption accounts, respectively. Recall that for modelling purposes it is necessary to separate institutions' income and consumption accounts. The rest of the specifications TAX and ROW define indirect taxes and the rest of the world accounts, respectively.

The Account Table is also important for defining the closures and parameterisation of the model. The model closures are defined in the column labelled FIX. It is shown that unskilled labour is fixed in quantities (Q), while skilled labour wage is fixed in nominal terms (NP). Rows 297-305 define the sector specificity of capital and the nominal exchange rate is fixed in row 363.

The columns labelled SIGMA and SIGMAR specify the elasticities of substitution and transformation, respectively. For example, the elasticities of substitution between the two labour types are shown in rows 288-296; and the elasticities of substitution between imported and domestic commodities are shown in rows 346-354. Similarly, rows 320-328 show the elasticities of substitution between value added and intermediate inputs and the elasticities of transformation between domestic and export sales. However, not all the required elasticities are contained in the Account Table. The export demand elasticities (ETA) are specified in lines 537-40. The SIGMAC Table (lines 541-580) contain the elasticities required for the two-stage CES production functions. The elasticities of substitution specified in the SIGMAC Table are those necessary for the production functions represented by the activity accounts in lines 403-447. They show that at the first level aggregate labour and capital combine to form value added in each sector; and on the same level intermediates combine to form aggregate intermediate input. Notice that to form value added labour and capital combine with similar elasticity of substitution. The same applies to intermediates, but because we assume these inputs combine with a Leontief technology (zero elasticity) a special specification (EPS) is used to represent zeros since as stated above they cannot be stored GAMS. Finally, in the top level value added combines with aggregate intermediates according to Leontief technology. The elasticities of substitution for these functions are specified as SIGMA in the Account Table (lines 320-328).

In lines 585-643, the parameters for the LES functions of rural and urban households are defined. These include the marginal budget shares (lines 585-605) obtained from expenditure surveys, the assumed committed expenditure shares (lines 606-607) and the estimated committed expenditures, discretionary expenditures, income and price elasticities (lines 624-641).

The experiment is specified in lines 682-683 and solved in line 684. Notice that the experiment involves 100% tariff reductions. The model therefore allows for large changes in policy.

The first results are shown on page 255 and represent LES results defined in lines 631 and 643. These results were discussed in Chapter Five. It is shown on pages 256-257 that the SAM is balanced. The row and column totals in each account are the same.

The counting of equations and variables of the model is shown in page 258. The model has 791 variables and 780 equations; therefore it is made determinate by fixing 11 variables and the numeraire. The base solution is shown in pages 259-261 and the model solution from page 262 onwards. To determine the policy effects, the model results is compared with the base results. The interpretation of the results are easy to follow. Drud and Kendrick (1986) provides the most complete discussed to such interpretations.

The actual results of our study are shown in pages 277-288. These are the results which involved experiments on tariff reductions (pp.277-278), devaluation (pp.279-80), subsidies (pp.281-282), increase on iments (279-280) and mark up pricing (pp.287-288).

```
* THE FOLLOWING IS A MODEL OF TRADE LIBERALISATION IN KENYA.
* THE MODEL IS COMPUTED USING HERCULES.
* AND IS BASED ON KENYA'S 1976 SAM.
 SET ACC ACCOUNTS /
          ULBRD       UNSKILLED DOMESTIC LABOUR
          SLBRD       SKILLED DOMESTIC LABOUR
          AGL-AG      AGGREGATE DOMESTIC LABOUR IN AGRICULTURE
          AGL-FOD     AGGREGATE DOMESTIC LABOUR IN FOODS SECTOR
          AGL-CON     AGGREGATE DOMESTIC LABOUR IN CONSUMER GOODS SECTOR
          AGL-PTR     AGGREGATE DOMESTIC LABOUR IN PETROLEUM SECTOR
          AGL-CEM     AGGREGATE DOMESTIC LABOUR IN CHEMICALS SECTOR
          AGL-MAN     AGGREGATE DOMESTIC LABOUR IN MANUFACTURING
          AGL-CNS     AGGREGATE DOMESTIC LABOUR IN CONSTRUCTION
          AGL-PSR     AGGREGATE DOMESTIC LABOUR IN PRIVATE SERVICES
          AGL-GSR     AGGREGATE DOMESTIC LABOUR IN PUBLIC SERVICES
          CAP-AGR     CAPITAL EMPLOYED IN AGRICULTURE
          CAP-FOOD    CAPITAL EMPLOYED IN FOOD
          CAP-CON     CAPITAL EMPLOYED IN CONSUMPTION
          CAP-PETR    CAPITAL EMPLOYED IN PETROLEUM AND MINING
          CAP-CHEM    CAPITAL EMPLOYED IN CHEMICALS
          CAP-MAN     CAPITAL EMPLOYED IN MANUFACTURING
          CAP-CONS    CAPITAL EMPLOYED IN CONSTRUCTION
          CAP-PSRV    CAPITAL EMPLOYED IN PRIVATE SERVICES
          CAP-GSRV    CAPITAL EMPLOYED IN PUBLIC SERVICES
          SLBRF       LABOR EMPLOYED ABROAD
          CAPITALF    CAPITAL EMPOLYED ABROAD
          ULBRT       TOTAL UNSKILLED LABOUR INCOME
          SLBRT       TOTAL LABOR INCOME
          CAPITALT    TOTAL CAPITAL INCOME
          RHSDY       RURAL HOUSEHOLD INCOME
          RHSDC       RURAL HOUSEHOLD CONSUMPTION
          UHSDY       URBAN HOUSEHOLD INCOME
          UHSDC       URBAN HOUSEHOLD CONSUMPTION
          COMPY       COMPANY INCOME
          GOVTY       GOVERNMENT INCOME
          GOVTC       GOVERNMENT CONSUMPTION
          SAV-INV     SAVINGS AND INVESTMENTS
          IND-TX      INDIRECT TAXES
          ACT-AGR     ACTIVITY IN AGRICULTURE
          ACT-FOOD    ACTIVITY IN FOOD
          ACT-CON     ACTIVITY IN CONSUMPTION
          ACT-PETR    ACTIVITY IN PETROLEUM IN MINING
          ACT-CHEM    ACTIVITY IN CHEMICALS
          ACT-MAN     ACTIVITY IN MANUFACTURES
          ACT-CONS    ACTIVITY IN CONSTRUCTION
          ACT-PSRV    ACTIVITY IN PRIVATE SERVICES
          ACT-GSRV    ACTIVITY IN PUBLIC SERVICES
          COM-AGRD    DOMESTIC COMMODITY AGRICULTURE
          COM-FOODD   DOMESTIC COMMODITY FOODS
          COM-COND    DOMESTIC COMMODITY CONSUMER GOODS
          COM-PETRD   DOMESTIC COMMODITY PETROLEUM
          COM-CHEMD   DOMESTIC COMMODITY CHEMICALS
          COM-MAND    DOMESTIC COMMODITY MANUFACTURES
          COM-CONSD   DOMESTIC COMMODITY CONSTRUCTION
          COM-PSRVD   DOMESTIC COMMODITY PRIVATE SERVICES
          COM-GSRVD   DOMESTIC COMMODITY  PUBLIC SERVICES
```

```
* THE FOLLOWING IS A MODEL OF TRADE LIBERALISATION IN KENYA.
* THE MODEL IS COMPUTED USING HERCULES.
* AND IS BASED ON KENYA'S 1976 SAM.
 SET ACC ACCOUNTS /
          ULBRD       UNSKILLED DOMESTIC LABOUR
          SLBRD       SKILLED DOMESTIC LABOUR
          AGL-AG      AGGREGATE DOMESTIC LABOUR IN AGRICULTURE
          AGL-FOD     AGGREGATE DOMESTIC LABOUR IN FOODS SECTOR
          AGL-CON     AGGREGATE DOMESTIC LABOUR IN CONSUMER GOODS SECTOR
          AGL-PTR     AGGREGATE DOMESTIC LABOUR IN PETROLEUM SECTOR
          AGL-CEM     AGGREGATE DOMESTIC LABOUR IN CHEMICALS SECTOR
          AGL-MAN     AGGREGATE DOMESTIC LABOUR IN MANUFACTURING
          AGL-CNS     AGGREGATE DOMESTIC LABOUR IN CONSTRUCTION
          AGL-PSR     AGGREGATE DOMESTIC LABOUR IN PRIVATE SERVICES
          AGL-GSR     AGGREGATE DOMESTIC LABOUR IN PUBLIC SERVICES
          CAP-AGR     CAPITAL EMPLOYED IN AGRICULTURE
          CAP-FOOD    CAPITAL EMPLOYED IN FOOD
          CAP-CON     CAPITAL EMPLOYED IN CONSUMPTION
          CAP-PETR    CAPITAL EMPLOYED IN PETROLEUM AND MINING
          CAP-CHEM    CAPITAL EMPLOYED IN CHEMICALS
          CAP-MAN     CAPITAL EMPLOYED IN MANUFACTURING
          CAP-CONS    CAPITAL EMPLOYED IN CONSTRUCTION
          CAP-PSRV    CAPITAL EMPLOYED IN PRIVATE SERVICES
          CAP-GSRV    CAPITAL EMPLOYED IN PUBLIC SERVICES
          SLBRF       LABOR EMPLOYED ABROAD
          CAPITALF    CAPITAL EMPOLYED ABROAD
          ULBRT       TOTAL UNSKILLED LABOUR INCOME
          SLBRT       TOTAL LABOR INCOME
          CAPITALT    TOTAL CAPITAL INCOME
          RHSDY       RURAL HOUSEHOLD INCOME
          RHSDC       RURAL HOUSEHOLD CONSUMPTION
          UHSDY       URBAN HOUSEHOLD INCOME
          UHSDC       URBAN HOUSEHOLD CONSUMPTION
          COMPY       COMPANY INCOME
          GOVTY       GOVERNMENT INCOME
          GOVTC       GOVERNMENT CONSUMPTION
          SAV-INV     SAVINGS AND INVESTMENTS
          IND-TX      INDIRECT TAXES
          ACT-AGR     ACTIVITY IN AGRICULTURE
          ACT-FOOD    ACTIVITY IN FOOD
          ACT-CON     ACTIVITY IN CONSUMPTION
          ACT-PETR    ACTIVITY IN PETROLEUM IN MINING
          ACT-CHEM    ACTIVITY IN CHEMICALS
          ACT-MAN     ACTIVITY IN MANUFACTURES
          ACT-CONS    ACTIVITY IN CONSTRUCTION
          ACT-PSRV    ACTIVITY IN PRIVATE SERVICES
          ACT-GSRV    ACTIVITY IN PUBLIC SERVICES
          COM-AGRD    DOMESTIC COMMODITY AGRICULTURE
          COM-FOODD   DOMESTIC COMMODITY FOODS
          COM-COND    DOMESTIC COMMODITY CONSUMER GOODS
          COM-PETRD   DOMESTIC COMMODITY PETROLEUM
          COM-CHEMD   DOMESTIC COMMODITY CHEMICALS
          COM-MAND    DOMESTIC COMMODITY MANUFACTURES
          COM-CONSD   DOMESTIC COMMODITY CONSTRUCTION
          COM-PSRVD   DOMESTIC COMMODITY PRIVATE SERVICES
          COM-GSRVD   DOMESTIC COMMODITY  PUBLIC SERVICES
```

```
          COM-AGRM   IMPORTED COMMODITY AGRICULTURE
          COM-FOODM  IMPORTED COMMODITY FOODS
          COM-CONM   IMPORTED COMMODITY CONSUMER GOODS
          COM-PETRM  IMPORTED COMMODITY PETROLEUM
          COM-CHEMM  IMPORTED COMMODITY CHEMICALS
          COM-MANM   IMPORTED COMMODITY MANUFACTURES
          COM-PSRVM  IMPORTED COMMODITY PRIVATE SERVICES
          COM-GSRVM  IMPORTED COMMODITY PUBLIC  SERVICES
          COM-AGRC   COMPOSITE COMMODITY AGRICULTURE
          COM-FOODC  COMPOSITE COMMODITY FOODS
          COM-CONC   COMPOSITE COMMODITY CONSUMER GOODS
          COM-PETRC  COMPOSITE COMMODITY PETROLEUM
          COM-CHEMC  COMPOSITE COMMODITY CHEMICALS
          COM-MANC   COMPOSITE COMMODITY MANUFACTURES
          COM-CONSC  COMPOSITE COMMODITY CONSTRUCTION
          COM-PSRVC   COMPOSITE COMMODITY PRIVATE SERVICES
          COM-GSRVC   COMPOSITE COMMODITY PUBLIC  SERVICES
          COM-AGRX   EXPORTS OF AGRICULTURE
          COM-FOODX  EXPORTS OF FOODS
          COM-CONX   EXPORTS OF CONSUMER GOODS
          COM-PETRX  EXPORTS OF PETROLEUM
          COM-CHEMX  EXPORTS OF CHEMICALS
          COM-MANX   EXPORTS OF MANUFACTURES
          COM-PSRVX  EXPORTS OF PRIVATE SERVICES
          COM-GSRVX  EXPORTS OF PUBLIC SERVICES
           RES-WRD   REST OF THE WORLD /

ALIAS (ACC,ACCP);

ACRONYMS MF      MARKET FACTOR ACCOUNT
         NMF     NON MARKET FACTOR ACCOUNT
         INST    INSTITUTION INCOME ACCOUNT
         INSTC   INSTITUTIONS CONSUMPTION ACCOUNT
         AC      ACTIVITY ACCOUNT
         Q       QUANTITY FIXED
         NP      PRICE FIXED AS NUMERAIRE
         P       FIXED PRICE
         CD      COBB DOUGLAS FUNCTION SPECIFICATION
         IDIST   INCOME DISTRIBUTION SPECIFICATION
         VSHR    FIXED VALUE SHARES CONSUMPTION SYSTEM
         TAX     INDIRECT TAX
         ROW     REST OF THE WORLD ACCOUNT
         CES     CES PRODUCTION FUNCTION
         CES2    TWO-STAGE CES PRODUCTION FUNCTION
         EXPORT  EARNINGS FROM EXORTS
         IMPORT  PAYMENTS FOR IMPORTS
         IO      INPUT-OUTPUT SPECIFICATION
         ITAX    INDIRECT TAX SPECIFICATION
         QEXO    FIXED QUANTITY CONSUMPTION SYSTEM
         QSHR    FIXED QUANTITY SHARES CONSUMPTION SYSTEM
         UNSPEC  UNSPECIFIED OR RESIDUAL
         VEXO    VALUE SHARE CONSUMPTION SYSTEM
         LES     LINEAR EXPENDITURE SYSTEM
         TEXO    EXOGENOUS VALUE IN DOMESTIC CURRENCY
         FEXO    EXOGENOUS VALUE IN FOREIGN CURRENCY
         RENT    SPECIFICATION FOR RENT UNDER IMPORT RATIONING
```

```
              MARKUP SPEC. FOR MARKUP PRICING UNDER EXCESS CAPACITY
              CET    CONSTANT ELASTICITY OF TRANSFORMATION
TABLE SAM(ACC,ACC) "1976 SOCIAL ACCOUNTING MATRIX FOR KENYA"

                     ULBRT     SLBRT     CAPITALT    RHSDY     RHSDC     UHSDY     UHSDC
RHSDY                412.2     97.5       14.6        5.6                 10.9
RHSDC                                               538.8
UHSDY                131.2     249.6
UHSDC
COMPY                                    320.9        3.2                374.7
GOVTY                                      2.0       37.6                  3.6
SAV-INV                                              48.0                 44.6
COM-AGRC                                                                  19.5
COM-FOODC                                                      262.9                29.9
COM-CONC                                                       105.8                62.3
COM-PETRC                                                       37.9                37.8
COM-CHEMC                                                        4.2                 3.9
COM-MANC                                                        22.4                21.5
COM-CONSC                                                       14.8                33.3
COM-PSRVC                                                        0.1                 0.3
COM-GSRVC                                                       82.3               171.3
RES-WRD                                                          8.5                14.4
                            , 12.4        70.0        1.8                 11.4

 +          COMPY      GOVTY     GOVTC     SAV-INV                   IND-TX
RHSDY        86.5        4.3
UHSDY        77.4        4.6
COMPY        16.4       12.3
GOVTY        79.5        7.3                                          175.5
GOVTC                  253.8
SAV-INV      97.3       77.5
COM-AGRC                                      39.9
COM-FOODC                                      1.2
COM-CONC                                       5.7
COM-PETRC                                      0.1
COM-CHEMC                                      0.0
COM-MANC                                     126.0
COM-CONSC                                    114.0
COM-PSRVC                                      7.3
COM-GSRVC                         253.8        0.0
RES-WRD       7.3        3.2

+           AGL-AG     AGL-FOD    AGL-CON    AGL-PTR    AGL-CEM
ULBRD       374.6      8.2         10.2        0.8        4.1
SLBRD         7.6      13.6        12.7        1.9        9.7

+           AGL-MAN    AGL-CNS    AGL-PSR    AGL-GSR
ULBRD         8.0      14.5        85.9       38.1
SLBRD        15.9      24.6       127.0      144.7
+           ACT-AGR    ACT-FOOD   ACT-CON    ACT-PETR      ACT-CHEM
AGL-AG      382.2
AGL-FOD                 21.8
AGL-CON                             22.9
AGL-PTR                                        2.7
AGL-CEM                                                   12.8
CAP-AGR     159.9
CAP-FOOD                31.6
```

```
CAP-CON                            13.1
CAP-PETR                                        5.8
CAP-CHEM                                                   20.8
COM-AGRC   31.6     108.7          4.4          0.0        8.0
COM-FOODC  6.0      87.1           3.0          0.0        14.7
COM-CONC   6.2      11.7           52.6         0.7        3.6
COM-PETRC  5.0      5.4            3.7          117.2      9.7
COM-CHEMC  17.0     13.1           10.3         2.1        29.1
COM-MANC   3.0      11.0           8.2          1.2        6.3
COM-CONSC  0.0      1.2            0.8          0.5        0.7
COM-PSRVC  14.6     28.6           19.3         3.1        9.9
COM-GSRVC  0.3      0.4            0.0          0.0        0.0

+        ACT-MAN  ACT-CONS    ACT-PSRV  ACT-GSRV
AGL-MAN    23.9
AGL-CNS              39.1
AGL-PSR                          212.9
AGL-GSR                                    182.8
CAP-MAN    14.4
CAP-CONS             7.1
CAP-PSRV                         140.4
CAP-GSRV                                    1.9
COM-AGRC   0.1       0.0         0.5        0.5
COM-FOODC  0.5       0.0         45.5       22.4
COM-CONC   3.2       5.5         13.8       5.9
COM-PETRC  4.6       21.7        38.3       5.8
COM-CHEMC  11.5      21.6        5.9        3.0
COM-MANC   67.0      29.1        34.5       4.8
COM-CONSC  0.7       20.5        6.0        17.9
COM-PSRVC  17.0      17.7        158.4      23.6
COM-GSRVC  0.0       0.0         0.0        0.6

+          COM-AGRD COM-FOODD  COM-COND   COM-PETRD COM-CHEMD
IND-TX       2.4      42.5       11.8       6.7       7.9
ACT-AGR      471.9
ACT-FOOD              284.4
ACT-CON                          120.1
ACT-PETR                                    85.4
ACT-CHEM                                              83.1

+          COM-MAND COM-CONSD  COM-PSRVD  COM-GSRVD
IND-TX       22.0     0.4        14.8       0.5
ACT-MAN      129.2
ACT-CONS              162.3
ACT-PSRV                         488.1
ACT-GSRV                                    268.0

+          COM-AGRM  COM-FOODM COM-CONM  COM-PETRM COM-CHEMM COM-MANM
IND-TX       0.7       4.0       11.6      19.3      5.4       25.2
RES-WRD      11.5      17.6      41.1      108.2     61.0      162.8

+            COM-PSRVM  COM-GSRVM
IND-TX         0.0        0.3
RES-WRD        50.2       9.2

+        COM-AGRC COM-FOODC  COM-CONC   COM-PETRC  COM-CHEMC
```

```
COM-AGRD  474.3
COM-FOODD            326.9
COM-COND                        131.9
COM-PETRD                                   92.1
COM-CHEMD                                              91.0
COM-AGRM   12.2
COM-FOODM             21.6
COM-CONM                         52.7
COM-PETRM                                  127.5
COM-CHEMM                                              66.4

+        COM-MANC  COM-CONSC  COM-PSRVC  COM-GSRVC
COM-MAND  151.2
COM-CONSD            162.7
COM-PSRVD                       502.9
COM-GSRVD                                  268.5
COM-MANM   188.0
COM-PSRVM                        50.2
COM-GSRVM                                    9.5
+        COM-AGRX   COM-FOODX  COM-CONX   COM-PETRX  COM-CHEMX
ACT-AGR   153.9
ACT-FOOD              36.2
ACT-CON                          18.2
ACT-PETR                                    47.9
ACT-CHEM                                               32.5

+        COM-MANX   COM-PSRVX  COM-GSRVX
ACT-MAN    13.7
ACT-PSRV             168.1
ACT-GSRV                          1.2

+           RES-WRD  ULBRD     SLBRD     SLBRF     CAPITALF
SLBRF       1.8
CAPITALF     12.5
RHSDY        3.4
UHSDY        1.9
COMPY        8.0
GOVTY        16.5
COM-AGRX     153.9
COM-FOODX    36.2
COM-CONX     18.2
COM-PETRX    47.9
COM-CHEMX    32.5
COM-MANX     13.7
COM-PSRVX    168.1
COM-GSRVX    1.2
SAV-INV      51.9
ULBRT                  543.4
SLBRT                            357.7     1.8
CAPITALT                                             12.5

+           CAP-AGR  CAP-FOOD  CAP-CON   CAP-PETR  CAP-CHEM  CAP-MAN
CAPITALT    159.9     31.6      13.1      5.8       20.8      14.4

+           CAP-CONS CAP-PSRV  CAP-GSRV
CAPITALT    7.1       140.4     1.9
```

```
TABLE AT(ACC,*) ACCOUNT TABLE

                    TYPE          FIX    SIGMA      SIGMAR
ULBRD               MF             Q
SLBRD               MF             NP
AGL-AG              AC                   0.88
AGL-FOD             AC                   0.69
AGL-CON             AC                   0.69
AGL-PTR             AC                   0.63
AGL-CEM             AC                   0.50
AGL-MAN             AC                   0.56
AGL-CNS             AC                   0.63
AGL-PSR             AC                   0.69
AGL-GSR             AC                   0.69
CAP-AGR             MF            Q
CAP-FOOD            MF            Q
CAP-CON             MF            Q
CAP-PETR            MF            Q
CAP-CHEM            MF            Q
CAP-MAN.            MF            Q
CAP-CONS            MF            Q
CAP-PSRV            MF            Q
CAP-GSRV            MF            Q
ULBRT               INST
SLBRT               INST
SLBRF               NMF
CAPITALF            NMF
CAPITALT            INST
RHSDY               INST
RHSDC               INSTC
UHSDY               INST
UHSDC               INSTC
COMPY               INST
GOVTY               INST
GOVTC               INSTC
SAV-INV             INSTC
IND-TX              TAX
ACT-AGR             AC                   EPS        -0.75
ACT-FOOD            AC                   EPS        -0.75
ACT-CON             AC                   EPS        -0.75
ACT-PETR            AC                   EPS        -0.25
ACT-CHEM            AC                   EPS        -0.25
ACT-MAN             AC                   EPS        -0.25
ACT-CONS            AC                   EPS         EPS
ACT-PSRV            AC                   EPS        -0.25
ACT-GSRV            AC                   EPS        -0.25
COM-AGRD            AC
COM-FOODD           AC
COM-COND            AC
COM-PETRD           AC
COM-CHEMD           AC
COM-MAND            AC
COM-CONSD           AC
COM-PSRVD           AC
COM-GSRVD           AC
```

```
COM-AGRM          AC
COM-FOODM         AC
COM-CONM          AC
COM-PETRM         AC
COM-CHEMM         AC
COM-MANM          AC
COM-PSRVM         AC
COM-GSRVM         AC
COM-AGRC          AC                    2.0
COM-FOODC         AC                    1.5
COM-CONC          AC                    1.5
COM-PETRC         AC                    0.66
COM-CHEMC         AC                    0.66
COM-MANC          AC                    0.66
COM-CONSC         AC                    EPS
COM-PSRVC         AC                    0.5
COM-GSRVC         AC                    0.5
COM-AGRX          AC
COM-FOODX         AC
COM-CONX          AC
COM-PETRX         AC
COM-CHEMX         AC
COM-MANX          AC
COM-PSRVX         AC
COM-GSRVX         AC
RES-WRD           ROW         P

TABLE SPEC(ACC,ACC)  SPECIFICATION TABLE

                  ULBRT    SLBRT    CAPITALT  RHSDY   RHSDC   UHSDY   UHSDC
RHSDY             IDIST    IDIST    IDIST     IDIST           IDIST
RHSDC                                         IDIST
UHSDY             IDIST    IDIST
UHSDC                                                         IDIST
COMPY                               IDIST     IDIST           IDIST
GOVTY                               IDIST     IDIST           IDIST
SAV-INV                                       IDIST           IDIST
COM-AGRC                                              LES             LES
COM-FOODC                                             LES             LES
COM-CONC                                              LES             LES
COM-PETRC                                             LES             LES
COM-CHEMC                                             LES             LES
COM-MANC                                              LES             LES
COM-CONSC                                             LES             LES
COM-PSRVC                                             LES             LES
COM-GSRVC                                             LES             LES
RES-WRD                    IDIST    IDIST     IDIST           IDIST

 +         COMPY     GOVTY     GOVTC     SAV-INV              IND-TX
RHSDY      IDIST     TEXO
UHSDY      IDIST     TEXO
COMPY      IDIST     TEXO
GOVTY      IDIST     TEXO                                     IDIST
GOVTC                UNSPEC
SAV-INV    IDIST     UNSPEC
COM-AGRC                                 VSHR
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COM-FOODC                                     VSHR
COM-CONC                                      VSHR
COM-PETRC                                     VSHR
COM-MANC                                      VSHR
COM-CONSC                                     VSHR
COM-PSRVC                                     VSHR
COM-GSRVC                          VEXO       VSHR
RES-WRD      IDIST      FEXO

+           AGL-AG     AGL-FOD    AGL-CON    AGL-PTR    AGL-CEM
ULBRD        CES        CES        CES        CES        CES
SLBRD        CES        CES        CES        CES        CES
+           AGL-MAN    AGL-CNS    AGL-PSR    AGL-GSR
ULBRD        CES        CES        CES        CES
SLBRD        CES        CES        CES        CES
+           ACT-AGR    ACT-FOOD   ACT-CON    ACT-PETR   ACT-CHEM
AGL-AG       CES2
AGL-FOD                 CES2
AGL-CON                            CES2
AGL-PTR                                       CES2
AGL-CEM                                                  CES2
CAP-AGR      CES2
CAP-FOOD                CES2
CAP-CON                            CES2
CAP-PETR                                      CES2
CAP-CHEM                                                 CES2
COM-AGRC     CES2       CES2       CES2       CES2       CES2
COM-FOODC    CES2       CES2       CES2       CES2       CES2
COM-CONC     CES2       CES2       CES2       CES2       CES2
COM-PETRC    CES2       CES2       CES2       CES2       CES2
COM-CHEMC    CES2       CES2       CES2       CES2       CES2
COM-MANC     CES2       CES2       CES2       CES2       CES2
COM-CONSC    CES2       CES2       CES2       CES2       CES2
COM-PSRVC    CES2       CES2       CES2       CES2       CES2
COM-GSRVC    CES2       CES2       CES2       CES2       CES2

+           ACT-MAN    ACT-CONS   ACT-PSRV   ACT-GSRV
AGL-MAN      CES2
AGL-CNS                 CES2
AGL-PSR                            CES2
AGL-GSR                                       CES2
CAP-MAN      CES2
CAP-CONS                CES2
CAP-PSRV                           CES2
CAP-GSRV                                      CES2
COM-AGRC     CES2       CES2       CES2       CES2
COM-FOODC    CES2       CES2       CES2       CES2
COM-CONC     CES2       CES2       CES2       CES2
COM-PETRC    CES2       CES2       CES2       CES2
COM-CHEMC    CES2       CES2       CES2       CES2
COM-MANC     CES2       CES2       CES2       CES2
COM-CONSC    CES2       CES2       CES2       CES2
COM-PSRVC    CES2       CES2       CES2       CES2
COM-GSRVC    CES2       CES2       CES2       CES2

+            COM-AGRD   COM-FOODD  COM-COND   COM-PETRD  COM-CHEMD
```

```
+               RES-WRD  ULBRD     SLBRD     SLBRF     CAPITALF
SLBRF           FEXO
CAPITALF        FEXO
RHSDY           FEXO
UHSDY           FEXO
COMPY           FEXO
GOVTY           FEXO
COM-AGRX        EXPORT
COM-FOODX       EXPORT
COM-CONX        EXPORT
COM-PETRX       EXPORT
COM-CHEMX       EXPORT
COM-MANX        EXPORT
COM-PSRVX       EXPORT
COM-GSRVX       EXPORT
SAV-INV         FEXO
ULBRT                    IDIST
SLBRT                              IDIST     IDIST
CAPITALT                                               IDIST

+               CAP-AGR  CAP-FOOD  CAP-CON   CAP-PETR  CAP-CHEM  CAP-MAN
CAPITALT        IDIST    IDIST     IDIST     IDIST     IDIST     IDIST

+               CAP-CONS CAP-PSRV  CAP-GSRV
CAPITALT        IDIST    IDIST     IDIST

SET ACCEX(ACC) EXPORTED COMMODITIES /COM-AGRX,COM-FOODX,COM-CONX,
                                     COM-PETRX,COM-CHEMX,COM-MANX,
                                     COM-PSRVX,COM-GSRVX/


PARAMETER ETAS(ACCEX) ELASTICITY OF DEMAND FOR EXPORTS
          /COM-AGRX=1.5,COM-FOODX=3.0,COM-CONX = 4.5,COM-PETRX=4.5,
           COM-CHEMX=4.5,COM-MANX=4.5, COM-PSRVX  1.0,
           COM-GSRVX=0.75;
 TABLE SIGMAC(ACC,ACC) CES2 ELASTICITIES
          ACT-AGR  ACT-FOOD  ACT-CON  ACT-PETR   ACT-CHEM
AGL-AG      0.75
AGL-FOD             0.75
AGL-CON                        0.75
AGL-PTR                                 0.75
AGL-CEM                                            0.50
CAP-AGR     0.75
CAP-FOOD            0.75
CAP-CON                        0.75
CAP-PETR                                0.75
CAP-CHEM                                           0.50
COM-AGRC    EPS     EPS        EPS      EPS        EPS
COM-FOODC   EPS     EPS        EPS      EPS        EPS
COM-CONC    EPS     EPS        EPS      EPS        EPS
COM-PETRC   EPS     EPS        EPS      EPS        EPS
COM-CHEMC   EPS     EPS        EPS      EPS        EPS
COM-MANC    EPS     EPS        EPS      EPS        EPS
COM-CONSC   EPS     EPS        EPS      EPS        EPS
COM-PSRVC   EPS     EPS        EPS      EPS        EPS
COM-GSRVC   EPS     EPS        EPS      EPS        EPS
```

```
+             ACT-MAN  ACT-CONS    ACT-PSRV  ACT-GSRV
AGL-MAN       0.70
AGL-CNS                0.50
AGL-PSR                            0.60
AGL-GSR                                      0.50
CAP-MAN       0.70
CAP-CONS               0.50
CAP-PSRV                           0.60
CAP-GSRV                                     0.50
COM-AGRC      EPS      EPS         EPS       EPS
COM-FOODC     EPS      EPS         EPS       EPS
COM-CONC      EPS      EPS         EPS       EPS
COM-PETRC     EPS      EPS         EPS       EPS
COM-CHEMC     EPS      EPS         EPS       EPS
COM-MANC      EPS      EPS         EPS       EPS
COM-CONSC     EPS      EPS         EPS       EPS
COM-PSRVC     EPS      EPS         EPS       EPS
COM-GSRVC     EPS      EPS         EPS       EPS


* DEFINE PARAMETERS FOR LES FUNCTIONS OF THE TWO HOUSEHOLDS.

  PARAMETER   BETAR(ACC)  BETA PARAMETER FOR RHSDC /
  COM-AGRC      0.57
  COM-FOODC     0.10
  COM-CONC      0.10
  COM-PETRC     EPS
  COM-CHEMC     0.04
  COM-MANC      0.04
  COM-CONSC     EPS
  COM-PSRVC     0.14
  COM-GSRVC     0.01/

  PARAMETER   BETAU(ACC)  BETA PARAMETER FOR UHSDC/
  COM-AGRC      0.08
  COM-FOODC     0.12
  COM-CONC      0.18
  COM-PETRC     0.02
  COM-CHEMC     0.05
  COM-MANC      0.10
  COM-CONSC     EPS
  COM-PSRVC     0.40
  COM-GSRVC     0.05/
  SCALAR        SUBS RSHDC COMMITTED EXPENDITURE SHARE /0.75/
                SUBSU UHSDC COMMITTED EXPENDITURE SHARE /0.70/
                EXPD RHSDC TOTAL EXPENDITURE
                EXPDU UHSDC TOTAL EXPENDITURE
                SUPR RHSDC DISCRETIONARY EXPENDITURE
                SUPRU UHSDC DISCRETIONARY EXPENDITURE
                FPR    FRISCH PARAMETER FOR RHSDC
                FPU    FRISCH PARAMETER FOR UHSDC;

  PARAMETER     ALPHAR(ACC)   ALPHA PARAMETER FOR RHSDC
                ALPHAU(ACC)   ALPHA PARAMETER FOR UHSDC
                SHARE(ACC)    SHARE PARAMETER FOR RHSDC
```

```
                 SHAREU(ACC)   SHARE PARAMETER FOR UHSDC
                 OPEL(ACC)     OWN PRICE ELASTICITY FOR RHSDC
                 OPELU(ACC)    OWN PRICE ELASTICITY FOR UHSDC
                 INEL(ACC)     INCOME ELASTICITY FOR RHSDC
                 INELU(ACC)    INCOME ELASTICITY FOR UHSDC;
                 EXPD=SUM(ACC,SAM(ACC,"RHSDC"));
                 SUPR=(1-SUBS)*EXPD;
                 ALPHAR(ACC)=SAM(ACC,"RHSDC")-BETAR(ACC)*SUPR;
                 OPEL(ACC)$ALPHAR(ACC)= -BETAR(ACC)*(SUPR+ALPHAR(ACC))/
                                         SAM(ACC,"RHSDC");
                 SHARE(ACC)  $ALPHAR(ACC)=ALPHAR(ACC)/SAM(ACC,"RHSDC");
                 INEL  (ACC)  $ALPHAR(ACC)=BETAR(ACC)*EXPD/SAM(ACC,"RHSDC");
                 FPR=-EXPD/SUPR;
   DISPLAY ALPHAR,BETAR,SHARE,INEL,OPEL,SUPR,FPR;


                 EXPDU=SUM(ACC,SAM(ACC,"UHSDC"));
                 SUPRU=(1-SUBSU)*EXPDU;
                 ALPHAU(ACC)=SAM(ACC,"UHSDC")-BETAU(ACC)*SUPRU;
                 OPELU(ACC)$ALPHAU(ACC)= -BETAU(ACC)*(SUPRU+ALPHAU(ACC))/
                                         SAM(ACC,"UHSDC");
                 SHAREU(ACC)  $ALPHAU(ACC)=ALPHAU(ACC)/SAM(ACC,"UHSDC");
               INELU  (ACC)  $ALPHAU(ACC)=BETAU(ACC)*EXPDU/SAM(ACC,"UHSDC");
                 FPU=-EXPDU/SUPRU;

   DISPLAY ALPHAU,BETAU,SHAREU,INELU,OPELU,SUPRU,FPU;


 * DEFINE AND FILL CELL TABLE:

  PARAMETER CT(ACC,ACC,*) CELL TABLE;

  CT(ACC,ACCP,"TBASE") = SAM(ACC,ACCP);
  CT(ACC,ACCP,"SPECS") = SPEC(ACC,ACCP);
  CT(ACCEX,"RES-WRD","ETA") = ETAS(ACCEX);
  CT(ACC,ACCP,"SIGMAC") = SIGMAC(ACC,ACCP);
  CT(ACC,"RHSDC","ALPHA")=ALPHAR(ACC);
  CT(ACC,"UHSDC","ALPHA")=ALPHAU(ACC);
  CT(ACC,"RHSDC","BETA")=BETAR(ACC);
  CT(ACC,"UHSDC","BETA")=BETAU(ACC);
  PARAMETER TOTALS(ACC,*) ACCOUNT TOTALS AND IMBALANCES FOR THE SAM;

     TOTALS(ACC,"ROW-TOTAL") = SUM(ACCP,SAM(ACC,ACCP));
     TOTALS(ACCP,"COL-TOTAL") = SUM(ACC,SAM(ACC,ACCP));
     TOTALS(ACC,"DIFFERENCE") = TOTALS(ACC,"ROW-TOTAL")-
                                TOTALS(ACC,"COL-TOTAL");

  DISPLAY "CHECK FOR BALANCE OF BASE SAM:",TOTALS;

  MODEL TRADE / ACC, AT, CT /;

  SOLVE TRADE USING HERCULES;
 * DEFINE SETS AND PARAMETERS FOR REPORT TABLES THAT SUMMARISE
 * ALL EXPERIMENTS AND DEFINE THE BASE CASE
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```
IND-TX     ITAX      ITAX      ITAX      ITAX      ITAX
ACT-AGR    CET
ACT-FOOD             CET
ACT-CON                        CET
ACT-PETR                                 CET
ACT-CHEM                                           CET

+         COM-MAND  COM-CONSD COM-PSRVD COM-GSRVD
IND-TX     ITAX      ITAX      ITAX      ITAX
ACT-MAN    CET
ACT-CONS             CET
ACT-PSRV                       CET
ACT-GSRV                                 CET

+         COM-AGRX  COM-FOODX COM-CONX  COM-PETRX COM-CHEMX
IND-TX     ITAX      ITAX      ITAX      ITAX      ITAX
ACT-AGR    CET
ACT-FOOD             CET
ACT-CON                        CET
ACT-PETR                                 CET
ACT-CHEM                                           CET

+         COM-MANX  COM-PSRVX COM-GSRVX
IND-TX     ITAX      ITAX      ITAX
ACT-MAN    CET
ACT-PSRV             CET
ACT-GSRV                       CET
+         COM-AGRM  COM-FOODM COM-CONM  COM-PETRM COM-CHEMM COM-MANM
IND-TX     ITAX      ITAX      ITAX      ITAX      ITAX      ITAX
RES-WRD    IMPORT    IMPORT    IMPORT    IMPORT    IMPORT    IMPORT

+         COM-PSRVM COM-GSRVM
IND-TX     ITAX      ITAX
RES-WRD    IMPORT    IMPORT

+         COM-AGRC  COM-FOODC COM-CONC  COM-PETRC COM-CHEMC
COM-AGRD   CES
COM-FOODD            CES
COM-COND                       CES
COM-PETRD                                CES
COM-CHEMD                                          CES
COM-AGRM   CES
COM-FOODM            CES
COM-CONM                       CES
COM-PETRM                                CES
COM-CHEMM                                          CES

+         COM-MANC  COM-CONSC COM-PSRVC COM-GSRVC
COM-MAND   CES
COM-CONSD            CES
COM-PSRVD                      CES
COM-GSRVD                                CES
COM-MANM   CES
COM-PSRVM                      CES
COM-GSRVM                                CES
```

```
SET ACCM(ACC) IMPORTED COMMODITIES
        /COM-AGRM,COM-FOODM,COM-CONM,COM-PETRM,COM-CHEMM, COM-MANM,
         COM-PSRVM,COM-GSRVM/;


*  POLICY SIMULATION
*  REDUCE TARIFFS ON IMPORTS BY 100%.

 CT("IND-TX",ACCM,"THETA")=
          CT("IND-TX",ACCM,"THETA-USED")*EPS;
SOLVE TRADE USING HERCULES;
DISPLAY AT,CT;

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COMPILATION TIME   =   3.940 SECONDS

```
----    631 PARAMETER ALPHAR         ALPHA PARAMETER FOR RHSDC

COM-AGRC  186.121,   COM-FOODC  92.330,   COM-CONC   24.430,   COM-PETRC   4.200,   COM-CHEMC  16.912,   COM-MANC    9.412
COM-CONSC   0.100,   COM-PSRVC  63.442,   COM-GSRVC   7.153

----    631 PARAMETER BETAR          BETA PARAMETER FOR RHSDC

COM-AGRC  0.570,   COM-FOODC 0.100,   COM-CONC  0.100,   COM-PETRC   EPS,   COM-CHEMC 0.040,   COM-MANC  0.040
COM-CONSC   EPS,   COM-PSRVC 0.140,   COM-GSRVC 0.010

----    631 PARAMETER SHARE          SHARE PARAMETER FOR RHSDC

COM-AGRC  0.708,   COM-FOODC 0.873,   COM-CONC  0.645,   COM-PETRC 1.000,   COM-CHEMC 0.758,   COM-MANC  0.636
COM-CONSC 1.000,   COM-PSRVC 0.771,   COM-GSRVC 0.842

----    631 PARAMETER INEL           INCOME ELASTICITY FOR RHSDC

COM-AGRC  1.168,   COM-FOODC 0.509,   COM-CONC  1.422,   COM-PETRC   EPS,   COM-CHEMC 0.966,   COM-MANC  1.456
COM-CONSC   EPS,   COM-PSRVC 0.917,   COM-GSRVC 0.634

----    631 PARAMETER OPEL           OWN PRICE ELASTICITY FOR RHSDC

COM-AGRC  -0.696,   COM-FOODC -0.215,   COM-CONC  -0.420,   COM-PETRC   EPS,   COM-CHEMC -0.272,   COM-MANC  -0.389
COM-CONSC    EPS,   COM-PSRVC -0.337,   COM-GSRVC -0.167

----    631 PARAMETER SUPR           =     134.700 RHSDC DISCRETIONARY EXPENDITURE
            PARAMETER FPR            =      -4.000 FRISCH PARAMETER FOR RHSDC

----    643 PARAMETER ALPHAU         ALPHA PARAMETER FOR UHSDC

COM-AGRC   20.907,   COM-FOODC  48.811,   COM-CONC   17.566,   COM-PETRC   1.652,   COM-CHEMC  15.879,   COM-MANC   22.059
COM-CONSC   0.300,   COM-PSRVC 126.336,   COM-GSRVC   8.779

----    643 PARAMETER BETAU          BETA PARAMETER FOR UHSDC

COM-AGRC  0.080,   COM-FOODC 0.120,   COM-CONC  0.180,   COM-PETRC 0.020,   COM-CHEMC 0.050,   COM-MANC  0.100
COM-CONSC   EPS,   COM-PSRVC 0.400,   COM-GSRVC 0.050

----    643 PARAMETER SHAREU         SHARE PARAMETER FOR UHSDC

COM-AGRC  0.699,   COM-FOODC 0.783,   COM-CONC  0.465,   COM-PETRC 0.424,   COM-CHEMC 0.739,   COM-MANC  0.662
COM-CONSC 1.000,   COM-PSRVC 0.738,   COM-GSRVC 0.610
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----     643 PARAMETER INELU          INCOME ELASTICITY FOR UHSDC

COM-AGRC  1.003,    COM-FOODC 0.722,    COM-CONC  1.784,    COM-PETRC 1.922,    COM-CHEMC 0.871,    COM-MANC  1.125
COM-CONSC   EPS,    COM-PSRVC 0.875,    COM-GSRVC 1.301

----     643 PARAMETER OPELU          OWN PRICE ELASTICITY FOR UHSDC

COM-AGRC  -0.357,   COM-FOODC -0.311,   COM-CONC  -0.619,   COM-PETRC -0.585,   COM-CHEMC -0.298,   COM-MANC  -0.404
COM-CONSC    EPS,   COM-PSRVC -0.557,   COM-GSRVC -0.421

----     643 PARAMETER SUPRU          =      112.410 UHSDC DISCRETIONARY EXPENDITURE
             PARAMETER FPU            =       -3.333 FRISCH PARAMETER FOR UHSDC

----     665 CHECK FOR BALANCE OF BASE SAM:

----     665 PARAMETER TOTALS         ACCOUNT TOTALS AND IMBALANCES FOR THE SAM
```

	ROW-TOTAL	COL-TOTAL	DIFFERENCE
ULBRD	543.400	543.400	-1.7053E-13
SLBRD	357.700	357.700	
AGL-AG	382.200	382.200	5.6843E-14
AGL-FOD	21.800	21.800	
AGL-CON	22.900	22.900	
AGL-PTR	2.700	2.700	2.2204E-16
AGL-CEM	12.800	12.800	
AGL-MAN	23.900	23.900	
AGL-CNS	39.100	39.100	
AGL-PSR	212.900	212.900	
AGL-GSR	182.800	182.800	
CAP-AGR	159.900	159.900	
CAP-FOOD	31.600	31.600	
CAP-CON	13.100	13.100	
CAP-PETR	5.800	5.800	
CAP-CHEM	20.800	20.800	
CAP-MAN	14.400	14.400	
CAP-CONS	7.100	7.100	
CAP-PSRV	140.400	140.400	
CAP-GSRV	1.900	1.900	
SLBRF	1.800	1.800	
CAPITALF	12.500	12.500	
ULBRT	543.400	543.400	
SLBRT	359.500	359.500	
CAPITALT	407.500	407.500	
RHSDY	635.000	635.000	
RHSDC	538.800	538.800	2.2737E-13
UHSDY	464.700	464.700	
UHSDC	374.700	374.700	5.6843E-14
COMPY	364.400	364.400	
GOVTY	363.000	363.000	
GOVTC	253.800	253.800	
SAV-INV	294.200	294.200	5.6843E-14

665 PARAMETER TOTALS ACCOUNT TOTALS AND IMBALANCES FOR THE SAM

	ROW-TOTAL	COL-TOTAL	DIFFERENCE
IND-TX	175.500	175.500	-2.1316E-14
ACT-AGR	625.800	625.800	1.1369E-13
ACT-FOOD	320.600	320.600	1.1369E-13
ACT-CON	138.300	138.300	1.4211E-14
ACT-PETR	133.300	133.300	3.5527E-15
ACT-CHEM	115.600	115.600	1.4211E-14
ACT-MAN	142.900	142.900	7.1054E-15
ACT-CONS	162.300	162.300	7.1054E-15
ACT-PSRV	656.200	656.200	1.1369E-13
ACT-GSRV	269.200	269.200	5.6843E-14
COM-AGRD	474.300	474.300	
COM-FOODD	326.900	326.900	
COM-COND	131.900	131.900	3.5527E-15
COM-PETRD	92.100	92.100	
COM-CHEMD	91.000	91.000	3.5527E-15
COM-MAND	151.200	151.200	
COM-CONSD	162.700	162.700	3.5527E-15
COM-PSRVD	502.900	502.900	5.6843E-14
COM-GSRVD	268.500	268.500	
COM-AGRM	12.200	12.200	
COM-FOODM	21.600	21.600	
COM-CONM	52.700	52.700	3.5527E-15
COM-PETRM	127.500	127.500	3.5527E-15
COM-CHEMM	66.400	66.400	
COM-MANM	188.000	188.000	3.5527E-15
COM-PSRVM	50.200	50.200	
COM-GSRVM	9.500	9.500	2.2204E-16
COM-AGRC	486.500	486.500	-1.1369E-13
COM-FOODC	348.500	348.500	
COM-CONC	184.600	184.600	-1.4211E-14
COM-PETRC	219.600	219.600	-1.0658E-14
COM-CHEMC	157.400	157.400	-1.4211E-14
COM-MANC	339.200	339.200	-1.1369E-13
COM-CONSC	162.700	162.700	-7.1054E-15
COM-PSRVC	553.100	553.100	-2.2737E-13
COM-GSRVC	278.000	278.000	-1.1369E-13
COM-AGRX	153.900	153.900	
COM-FOODX	36.200	36.200	
COM-CONX	18.200	18.200	
COM-PETRX	47.900	47.900	
COM-CHEMX	32.500	32.500	
COM-MANX	13.700	13.700	
COM-PSRVX	168.100	168.100	
COM-GSRVX	1.200	1.200	
RES-WRD	567.700	567.700	

H E R C U L E S --- VERSION 1.11 FROM 02/23/87

SERIAL NUMBER 203
INSTITUTIONAL LICENSE TO: DEPARTMENT OF ECONOMICS
UNIVERSITY OF WARWICK
UNITED KINGDOM.

SAM STATISTICS:	ACCOUNTS	CELLS
BEFORE EXPANSION	78	274
AFTER EXPANSION	89	300

MODEL STATISTICS:

VARIABLES	TOTAL	EXPLICIT	IMPLICIT	EXOGENOUS
P-VARIABLES	79	77	2	2
Q-VARIABLES	78		78	10
Y-VARIABLES	89	89	0	0
T-VARIABLES	300	300		
C-VARIABLES	245		245	
RESIDUAL	1	1		
TOTAL	792	467	325	12

EQUATIONS	TOTAL	EXPLICIT	IMPLICIT
ROW EQUATIONS	89	89	
COLUMN EQUATIONS	72	72	
P*Q=Y EQUATIONS	78	10	68
T(I,J) EQUATIONS	296	296	
C(I,J) EQUATIONS	245		245
FIXED VARIABLES	11		11
NUMERAIRE	1		1
TOTAL	792	467	325

VARIABLE AND EQUATION BALANCE BY MAJOR ACCOUNT TYPE:
(CELLS ARE COUNTED WITH THEIR COLUMN, EXCEPT IN
REST OF WORLD ACCOUNTS WHERE CELLS IN INSTITUTIONS
ROWS ARE COUNTED WITH INSTITUTIONS)

	VARIABLES	EQUATIONS	IMBALANCE
FACTORS	48	47	1
INSTITUTIONS	116	116	0
ACTIVITIES/COMMODITIES/ REST-OF-WORLD	625	626	-1
INDIRECT TAXES	2	2	0
NUMERAIRE/RESIDUAL	1	1	
TOTALS	792	792	0

SIZE OF LARGEST SIMULTANEOUS BLOCK: 406
TOTAL NUMBER OF SPIKES: 43

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1296.100	1296.100	1.000
NET INDIRECT TAXES	175.500	175.500	175.500	
INCOME EFFECT			0.000	
FINAL USE	1461.500	1461.500	1461.500	1.000
EXPORTS	471.700	471.700	471.700	1.000
IMPORTS	-461.600	-461.600	-461.600	1.000
GDP AT MARKET PRICES	1471.600	1471.600	1471.600	1.000
TERMS OF TRADE			0.000	
GROSS DOMESTIC INCOME	1471.600	1471.600	1471.600	
RESOURCE GAP	-10.100	-10.100	-10.100	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 0

SOLUTION TIME 5.063 SECONDS

WORK SPACE NEEDED -- 8352 WORDS.
WORK SPACE AVAILABLE -- 276961 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE
ULBRD	1.000	543.400	543.400	543.400
SLBRD	1.000	357.700	357.700	357.700
AGL-AG	1.000	382.200	382.200	382.200
AGL-FOD	1.000	21.800	21.800	21.800
AGL-CON	1.000	22.900	22.900	22.900
AGL-PTR	1.000	2.700	2.700	2.700
AGL-CEM	1.000	12.800	12.800	12.800
AGL-MAN	1.000	23.900	23.900	23.900
AGL-CNS	1.000	39.100	39.100	39.100
AGL-PSR	1.000	212.900	212.900	212.900
AGL-GSR	1.000	182.800	182.800	182.800
CAP-AGR	1.000	159.900	159.900	159.900
CAP-FOOD	1.000	31.600	31.600	31.600
CAP-CON	1.000	13.100	13.100	13.100
CAP-PETR	1.000	5.800	5.800	5.800
CAP-CHEM	1.000	20.800	20.800	20.800
CAP-MAN	1.000	14.400	14.400	14.400
CAP-CONS	1.000	7.100	7.100	7.100
CAP-PSRV	1.000	140.400	140.400	140.400
CAP-GSRV	1.000	1.900	1.900	1.900
SLBRF			1.800	1.800

S O L U T I O N   S U M M A R Y

	PSOL	QSOL	YSOL	YBASE
CAPITALF			12.500	12.500
ULBRT			543.400	543.400
SLBRT			359.500	359.500
CAPITALT			407.500	407.500
RHSDY			635.000	635.000
RHSDC	1.000	538.800	538.800	538.800
UHSDY			464.700	464.700
UHSDC	1.000	374.700	374.700	374.700
COMPY			364.400	364.400
GOVTY			363.000	363.000
GOVTC	1.000	253.800	253.800	253.800
SAV-INV	1.000	294.200	294.200	294.200
IND-TX			175.500	175.500
ACT-AGR	1.000	625.800	625.800	625.800
ACT-FOOD	1.000	320.600	320.600	320.600
ACT-CON	1.000	138.300	138.300	138.300
ACT-PETR	1.000	133.300	133.300	133.300
ACT-CHEM	1.000	115.600	115.600	115.600
ACT-MAN	1.000	142.900	142.900	142.900
ACT-CONS	1.000	162.300	162.300	162.300
ACT-PSRV	1.000	656.200	656.200	656.200
ACT-GSRV	1.000	269.200	269.200	269.200
COM-AGRD	1.000	474.300	474.300	474.300
COM-FOODD	1.000	326.900	326.900	326.900
COM-COND	1.000	131.900	131.900	131.900
COM-PETRD	1.000	92.100	92.100	92.100
COM-CHEMD	1.000	91.000	91.000	91.000
COM-MAND	1.000	151.200	151.200	151.200
COM-CONSD	1.000	162.700	162.700	162.700
COM-PSRVD	1.000	502.900	502.900	502.900
COM-GSRVD	1.000	268.500	268.500	268.500
COM-AGRM	1.000	12.200	12.200	12.200
COM-FOODM	1.000	21.600	21.600	21.600
COM-CONM	1.000	52.700	52.700	52.700
COM-PETRM	1.000	127.500	127.500	127.500
COM-CHEMM	1.000	66.400	66.400	66.400
COM-MANM	1.000	188.000	188.000	188.000
COM-PSRVM	1.000	50.200	50.200	50.200
COM-GSRVM	1.000	9.500	9.500	9.500
COM-AGRC	1.000	486.500	486.500	486.500
COM-FOODC	1.000	348.500	348.500	348.500
COM-CONC	1.000	184.600	184.600	184.600
COM-PETRC	1.000	219.600	219.600	219.600
COM-CHEMC	1.000	157.400	157.400	157.400
COM-MANC	1.000	339.200	339.200	339.200
COM-CONSC	1.000	162.700	162.700	162.700
COM-PSRVC	1.000	553.100	553.100	553.100
COM-GSRVC	1.000	278.000	278.000	278.000
COM-AGRX	1.000	153.900	153.900	153.900
COM-FOODX	1.000	36.200	36.200	36.200
COM-CONX	1.000	18.200	18.200	18.200
COM-PETRX	1.000	47.900	47.900	47.900

S O L U T I O N   S U M M A R Y

	PSOL	QSOL	YSOL	YBASE
COM-CHEMX	1.000	32.500	32.500	32.500
COM-MANX	1.000	13.700	13.700	13.700
COM-PSRVX	1.000	168.100	168.100	168.100
COM-GSRVX	1.000	1.200	1.200	1.200
RES-WRD	1.000		567.700	567.700

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1297.742	1296.575	1.001
NET INDIRECT TAXES	175.500	99.983	176.362	
INCOME EFFECT			-2.062	
FINAL USE	1461.500	1387.159	1457.096	0.952
EXPORTS	471.700	479.077	482.289	0.993
IMPORTS	-461.600	-468.511	-468.511	1.000
GDP AT MARKET PRICES	1471.600	1397.725	1470.875	0.950
TERMS OF TRADE			1.212	
GROSS DOMESTIC INCOME	1471.600	1397.725	1467.663	
RESOURCE GAP	-10.100	-10.567	-10.567	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 8

SOLUTION TIME 6.280 SECONDS

WORK SPACE NEEDED -- 8352 WORDS.
WORK SPACE AVAILABLE -- 276961 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	0.998	543.400	542.236	543.400	
SLBRD	1.000	358.175	358.175	357.700	
AGL-AG	0.998	382.548	381.745	382.200	
AGL-FOD	0.999	21.914	21.897	21.800	
AGL-CON	0.999	22.055	22.034	22.900	
AGL-PTR	0.999	3.514	3.511	2.700	
AGL-CEM	0.999	12.665	12.659	12.800	
AGL-MAN	0.999	21.036	21.021	23.900	
AGL-CNS	0.999	32.726	32.700	39.100	
AGL-PSR	0.999	217.878	217.689	212.900	
AGL-GSR	1.000	187.238	187.155	182.800	
CAP-AGR	0.999	159.900	159.758	159.900	
CAP-FOOD	1.006	31.600	31.796	31.600	
CAP-CON	0.950	13.100	12.448	13.100	
CAP-PETR	1.420	5.800	8.236	5.800	
CAP-CHEM	0.979	20.800	20.353	20.800	
CAP-MAN	0.833	14.400	11.991	14.400	
CAP-CONS	0.700	7.100	4.970	7.100	
CAP-PSRV	1.038	140.400	145.787	140.400	
CAP-GSRV	1.049	1.900	1.992	1.900	
SLBRF			1.800	1.800	

S O L U T I O N   S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
CAPITALF			12.500	12.500	
ULBRT			542.236	543.400	
SLBRT			359.975	359.500	
CAPITALT			409.831	407.500	
RHSDY			634.795	635.000	
RHSDC	0.963	559.196	538.626	538.800	-0.147
UHSDY			465.158	464.700	
UHSDC	0.947	395.958	375.069	374.700	-0.182
COMPY			366.325	364.400	
GOVTY			287.946	363.000	
GOVTC	0.978	259.545	253.800	253.800	
SAV-INV	0.908	241.877	219.663	294.200	-0.190
IND-TX			99.982	175.500	
ACT-AGR	0.991	626.202	620.789	625.800	-0.002
ACT-FOOD	0.966	321.286	310.290	320.600	-0.012
ACT-CON	0.922	135.025	124.552	138.300	-0.053
ACT-PETR	0.860	144.575	124.291	133.300	-0.277
ACT-CHEM	0.941	115.133	108.291	115.600	-0.021
ACT-MAN	0.907	131.851	119.576	142.900	-0.119
ACT-CONS	0.911	139.332	126.985	162.300	-0.164
ACT-PSRV	0.978	665.375	650.416	656.200	-0.046
ACT-GSRV	0.978	275.667	269.649	269.200	-0.001
COM-AGRD	0.990	473.962	469.017	474.300	
COM-FOODD	0.962	326.723	314.418	326.900	
COM-COND	0.911	127.617	116.308	131.900	
COM-PETRD	0.793	97.899	77.650	92.100	
COM-CHEMD	0.918	90.084	82.699	91.000	
COM-MAND	0.896	139.073	124.553	151.200	
COM-CONSD	0.911	139.675	127.298	162.700	
COM-PSRVD	0.972	509.187	494.842	502.900	
COM-GSRVD	0.978	274.953	268.958	268.500	
COM-AGRM	0.943	13.436	12.665	12.200	
COM-FOODM	0.815	27.709	22.578	21.600	
COM-CONM	0.780	64.413	50.235	52.700	
COM-PETRM	0.849	129.615	109.995	127.500	
COM-CHEMM	0.919	65.701	60.358	66.400	
COM-MANM	0.866	176.805	153.105	188.000	
COM-PSRVM	1.000	50.107	50.107	50.200	
COM-GSRVM	0.968	9.777	9.469	9.500	
COM-AGRC	0.988	487.369	481.682	486.500	-0.029
COM-FOODC	0.952	353.961	336.995	348.500	-0.471
COM-CONC	0.871	191.289	166.543	184.600	-0.742
COM-PETRC	0.825	227.430	187.645	219.600	-0.084
COM-CHEMC	0.918	155.785	143.057	157.400	
COM-MANC	0.879	315.849	277.658	339.200	-0.029
COM-CONSC	0.911	139.675	127.298	162.700	
COM-PSRVC	0.974	559.284	544.949	553.100	-0.009
COM-GSRVC	0.978	284.730	278.427	278.000	
COM-AGRX	0.997	154.636	154.145	153.900	
COM-FOODX	0.992	37.027	36.750	36.200	
COM-CONX	0.993	18.779	18.649	18.200	
COM-PETRX	0.975	53.616	52.289	47.900	

S O L U T I O N   S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
COM-CHEMX	0.998	32.849	32.771	32.500	
COM-MANX	1.012	12.992	13.146	13.700	
COM-PSRVX	0.994	171.164	170.137	168.100	
COM-GSRVX	0.971	1.227	1.191	1.200	
RES-WRD	1.000		575.077	567.700	

---- 685 PARAMETER AT ACCOUNT TABLE

	TYPE	FIX	SIGMA	SIGMAR	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	MF	Q			0.998	543.400	542.236	543.400	
SLBRD	MF	NP			1.000	358.175	358.175	357.700	
AGL-AG	AC		0.880		0.998	382.548	381.745	382.200	
AGL-FOD	AC		0.690		0.999	21.914	21.897	21.800	
AGL-CON	AC		0.690		0.999	22.055	22.034	22.900	
AGL-PTR	AC		0.630		0.999	3.514	3.511	2.700	
AGL-CEM	AC		0.500		0.999	12.665	12.659	12.800	
AGL-MAN	AC		0.560		0.999	21.036	21.021	23.900	
AGL-CNS	AC		0.630		0.999	32.726	32.700	39.100	
AGL-PSR	AC		0.690		0.999	217.878	217.689	212.900	
AGL-GSR	AC		0.690		1.000	187.238	187.155	182.800	
CAP-AGR	MF	Q			0.999	159.900	159.758	159.900	
CAP-FOOD	MF	Q			1.006	31.600	31.796	31.600	
CAP-CON	MF	Q			0.950	13.100	12.448	13.100	
CAP-PETR	MF	Q			1.420	5.800	8.236	5.800	
CAP-CHEM	MF	Q			0.979	20.800	20.353	20.800	
CAP-MAN	MF	Q			0.833	14.400	11.991	14.400	
CAP-CONS	MF	Q			0.700	7.100	4.970	7.100	
CAP-PSRV	MF	Q			1.038	140.400	145.787	140.400	
CAP-GSRV	MF	Q			1.049	1.900	1.992	1.900	
SLBRF	NMF						1.800	1.800	
CAPITALF	NMF						12.500	12.500	
ULBRT	INST						542.236	543.400	
SLBRT	INST						359.975	359.500	
CAPITALT	INST						409.831	407.500	
RHSDY	INST						634.795	635.000	
RHSDC	INSTC				0.963	559.196	538.626	538.800	-0.147
UHSDY	INST						465.158	464.700	
UHSDC	INSTC				0.947	395.958	375.069	374.700	-0.182
COMPY	INST						366.325	364.400	
GOVTY	INST						287.946	363.000	
GOVTC	INSTC				0.978	259.545	253.800	253.800	
SAV-INV	INSTC				0.908	241.877	219.663	294.200	-0.190
IND-TX	TAX						99.982	175.500	
ACT-AGR	AC		EPS	-0.750	0.991	626.202	620.789	625.800	-0.002
ACT-FOOD	AC		EPS	-0.750	0.966	321.286	310.290	320.600	-0.012
ACT-CON	AC		EPS	-0.750	0.922	135.025	124.552	138.300	-0.053
ACT-PETR	AC		EPS	-0.250	0.860	144.575	124.291	133.300	-0.277
ACT-CHEM	AC		EPS	-0.250	0.941	115.133	108.291	115.600	-0.021
ACT-MAN	AC		EPS	-0.250	0.907	131.851	119.576	142.900	-0.119
ACT-CONS	AC		EPS	EPS	0.911	139.332	126.985	162.300	-0.164
ACT-PSRV	AC		EPS	-0.250	0.978	665.375	650.416	656.200	-0.046
ACT-GSRV	AC		EPS	-0.250	0.978	275.667	269.649	269.200	-0.001
COM-AGRD	AC				0.990	473.962	469.017	474.300	
COM-FOODD	AC				0.962	326.723	314.418	326.900	
COM-COND	AC				0.911	127.617	116.308	131.900	
COM-PETRD	AC				0.793	97.899	77.650	92.100	
COM-CHEMD	AC				0.918	90.084	82.699	91.000	
COM-MAND	AC				0.896	139.073	124.553	151.200	
COM-CONSD	AC				0.911	139.675	127.298	162.700	
COM-PSRVD	AC				0.972	509.187	494.842	502.900	
COM-GSRVD	AC				0.978	274.953	268.958	268.500	

685 PARAMETER AT ACCOUNT TABLE

	TYPE	FIX	SIGMA	SIGMAR	PSOL	QSOL	YSOL	YBASE	RESIDUAL
COM-AGRM	AC				0.943	13.436	12.665	12.200	
COM-FOODM	AC				0.815	27.709	22.578	21.600	
COM-CONM	AC				0.780	64.413	50.235	52.700	
COM-PETRM	AC				0.849	129.615	109.995	127.500	
COM-CHEMM	AC				0.919	65.701	60.358	66.400	
COM-MANM	AC				0.866	176.805	153.105	188.000	
COM-PSRVM	AC				1.000	50.107	50.107	50.200	
COM-GSRVM	AC				0.968	9.777	9.469	9.500	
COM-AGRC	AC		2.000		0.988	487.369	481.682	486.500	-0.029
COM-FOODC	AC		1.500		0.952	353.961	336.995	348.500	-0.471
COM-CONC	AC		1.500		0.871	191.289	166.543	184.600	-0.742
COM-PETRC	AC		0.660		0.825	227.430	187.645	219.600	-0.084
COM-CHEMC	AC		0.660		0.918	155.785	143.057	157.400	
COM-MANC	AC		0.660		0.879	315.849	277.658	339.200	-0.029
COM-CONSC	AC		EPS		0.911	139.675	127.298	162.700	
COM-PSRVC	AC		0.500		0.974	559.284	544.949	553.100	-0.009
COM-GSRVC	AC		0.500		0.978	284.730	278.427	278.000	
COM-AGRX	AC				0.997	154.636	154.145	153.900	
COM-FOODX	AC				0.992	37.027	36.750	36.200	
COM-CONX	AC				0.993	18.779	18.649	18.200	
COM-PETRX	AC				0.975	53.616	52.289	47.900	
COM-CHEMX	AC				0.998	32.849	32.771	32.500	
COM-MANX	AC				1.012	12.992	13.146	13.700	
COM-PSRVX	AC				0.994	171.164	170.137	168.100	
COM-GSRVX	AC				0.971	1.227	1.191	1.200	
RES-WRD	ROW	P			1.000		575.077	567.700	

---- 685 PARAMETER CT CELL TABLE

		TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
ULBRD	.AGL-AG	374.600	CES					374.152	374.955	
ULBRD	.AGL-FOD	8.200	CES					8.233	8.251	
ULBRD	.AGL-CON	10.200	CES					9.811	9.832	
ULBRD	.AGL-PTR	0.800	CES					1.040	1.042	
ULBRD	.AGL-CEM	3.100	CES					3.063	3.070	
ULBRD	.AGL-MAN	8.000	CES					7.032	7.047	
ULBRD	.AGL-CNS	14.500	CES					12.120	12.146	
ULBRD	.AGL-PSR	85.900	CES					87.798	87.986	
ULBRD	.AGL-GSR	38.100	CES					38.987	39.071	
SLBRD	.AGL-AG	7.600	CES					7.593	7.593	
SLBRD	.AGL-FOD	13.600	CES					13.664	13.664	
SLBRD	.AGL-CON	12.700	CES					12.223	12.223	
SLBRD	.AGL-PTR	1.900	CES					2.472	2.472	
SLBRD	.AGL-CEM	9.700	CES					9.595	9.595	
SLBRD	.AGL-MAN	15.900	CES					13.989	13.989	
SLBRD	.AGL-CNS	24.600	CES					20.579	20.579	
SLBRD	.AGL-PSR	127.000	CES					129.892	129.892	
SLBRD	.AGL-GSR	144.700	CES					148.168	148.168	
AGL-AG	.ACT-AGR	382.200	CES2		0.750			381.745	382.548	
AGL-FOD	.ACT-FOOD	21.800	CES2		0.750			21.897	21.914	

685 PARAMETER CT CELL TABLE

		TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
AGL-CON	.ACT-CON	22.900	CES2		0.750			22.034	22.055	
AGL-PTR	.ACT-PETR	2.700	CES2		0.750			3.511	3.514	
AGL-CEM	.ACT-CHEM	12.800	CES2		0.500			12.659	12.665	
AGL-MAN	.ACT-MAN	23.900	CES2		0.700			21.021	21.036	
AGL-CNS	.ACT-CONS	39.100	CES2		0.500			32.700	32.726	
AGL-PSR	.ACT-PSRV	212.900	CES2		0.600			217.689	217.878	
AGL-GSR	.ACT-GSRV	182.800	CES2		0.500			187.155	187.238	
CAP-AGR	.ACT-AGR	159.900	CES2		0.750			159.758	159.900	
CAP-FOOD	.ACT-FOOD	31.600	CES2		0.750			31.796	31.600	
CAP-CON	.ACT-CON	13.100	CES2		0.750			12.448	13.100	
CAP-PETR	.ACT-PETR	5.800	CES2		0.750			8.236	5.800	
CAP-CHEM	.ACT-CHEM	20.800	CES2		0.500			20.353	20.800	
CAP-MAN	.ACT-MAN	14.400	CES2		0.700			11.991	14.400	
CAP-CONS	.ACT-CONS	7.100	CES2		0.500			4.970	7.100	
CAP-PSRV	.ACT-PSRV	140.400	CES2		0.600			145.787	140.400	
CAP-GSRV	.ACT-GSRV	1.900	CES2		0.500			1.992	1.900	
SLBRF	.RES-WRD	1.800	FEXO					1.800		
CAPITALF	.RES-WRD	12.500	FEXO					12.500		
ULBRT	.ULBRD	543.400	IDIST					542.236		
SLBRT	.SLBRD	357.700	IDIST					358.175		
SLBRT	.SLBRF	1.800	IDIST					1.800		
CAPITALT	.CAP-AGR	159.900	IDIST					159.758		
CAPITALT	.CAP-FOOD	31.600	IDIST					31.796		
CAPITALT	.CAP-CON	13.100	IDIST					12.448		
CAPITALT	.CAP-PETR	5.800	IDIST					8.236		
CAPITALT	.CAP-CHEM	20.800	IDIST					20.353		
CAPITALT	.CAP-MAN	14.400	IDIST					11.991		
CAPITALT	.CAP-CONS	7.100	IDIST					4.970		
CAPITALT	.CAP-PSRV	140.400	IDIST					145.787		
CAPITALT	.CAP-GSRV	1.900	IDIST					1.992		
CAPITALT	.CAPITALF	12.500	IDIST					12.500		
RHSDY	.ULBRT	412.200	IDIST					411.317		
RHSDY	.SLBRT	97.500	IDIST					97.629		
RHSDY	.CAPITALT	14.600	IDIST					14.684		
RHSDY	.RHSDY	5.600	IDIST					5.598		
RHSDY	.UHSDY	10.900	IDIST					10.911		
RHSDY	.COMPY	86.500	IDIST					86.957		
RHSDY	.GOVTY	4.300	TEXO					4.300		
RHSDY	.RES-WRD	3.400	FEXO					3.400		
RHSDC	.RHSDY	538.800	IDIST					538.626		
UHSDY	.ULBRT	131.200	IDIST					130.919		
UHSDY	.SLBRT	249.600	IDIST					249.930		
UHSDY	.COMPY	77.400	IDIST					77.809		
UHSDY	.GOVTY	4.600	TEXO					4.600		
UHSDY	.RES-WRD	1.900	FEXO					1.900		
UHSDC	.UHSDY	374.700	IDIST					375.069		
COMPY	.CAPITALT	320.900	IDIST					322.736		
COMPY	.RHSDY	3.200	IDIST					3.199		
COMPY	.UHSDY	3.600	IDIST					3.604		
COMPY	.COMPY	16.400	IDIST					16.487		
COMPY	.GOVTY	12.300	TEXO					12.300		
COMPY	.RES-WRD	8.000	FEXO					8.000		

685 PARAMETER CT CELL TABLE

		TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
GOVTY	.CAPITALT	2.000	IDIST					2.011		
GOVTY	.RHSDY	37.600	IDIST					37.588		
GOVTY	.UHSDY	44.600	IDIST					44.644		
GOVTY	.COMPY	79.500	IDIST					79.920		
GOVTY	.GOVTY	7.300	TEXO					7.300		
GOVTY	.IND-TX	175.500	IDIST					99.982		
GOVTY	.RES-WRD	16.500	FEXO					16.500		
GOVTC	.GOVTY	253.800	UNSPEC					253.800		
SAV-INV	.RHSDY	48.000	IDIST					47.985		
SAV-INV	.UHSDY	19.500	IDIST					19.519		
SAV-INV	.COMPY	97.300	IDIST					97.814		
SAV-INV	.GOVTY	77.500	UNSPEC					2.446		
SAV-INV	.RES-WRD	51.900	FEXO					51.900		
IND-TX	.COM-AGRD	2.400	ITAX					2.373	2.398	
IND-TX	.COM-FOODD	42.500	ITAX					40.877	42.477	
IND-TX	.COM-COND	11.800	ITAX					10.405	11.417	
IND-TX	.COM-PETRD	6.700	ITAX					5.649	7.122	
IND-TX	.COM-CHEMD	7.900	ITAX					7.179	7.820	
IND-TX	.COM-MAND	22.000	ITAX					18.123	20.235	
IND-TX	.COM-CONSD	0.400	ITAX					0.313	0.343	
IND-TX	.COM-PSRVD	14.800	ITAX					14.563	14.985	
IND-TX	.COM-GSRVD	0.500	ITAX					0.501	0.512	
IND-TX	.COM-AGRM	0.700	ITAX						0.771	EPS
IND-TX	.COM-FOODM	4.000	ITAX						5.131	EPS
IND-TX	.COM-CONM	11.600	ITAX						14.178	EPS
IND-TX	.COM-PETRM	19.300	ITAX						19.620	EPS
IND-TX	.COM-CHEMM	5.400	ITAX						5.343	EPS
IND-TX	.COM-MANM	25.200	ITAX						23.699	EPS
IND-TX	.COM-PSRVM		ITAX							EPS
IND-TX	.COM-GSRVM	0.300	ITAX						0.309	EPS
IND-TX	.COM-AGRX		ITAX							
IND-TX	.COM-FOODX		ITAX							
IND-TX	.COM-CONX		ITAX							
IND-TX	.COM-PETRX		ITAX							
IND-TX	.COM-CHEMX		ITAX							
IND-TX	.COM-MANX		ITAX							
IND-TX	.COM-PSRVX		ITAX							
IND-TX	.COM-GSRVX		ITAX							
ACT-AGR	.COM-AGRD	471.900	CET					466.644	471.564	
ACT-AGR	.COM-AGRX	153.900	CET					154.145	154.636	
ACT-FOOD	.COM-FOODD	284.400	CET					273.541	284.246	
ACT-FOOD	.COM-FOODX	36.200	CET					36.750	37.028	
ACT-CON	.COM-COND	120.100	CET					105.902	116.200	
ACT-CON	.COM-CONX	18.200	CET					18.649	18.779	
ACT-PETR	.COM-PETRD	85.400	CET					72.001	90.777	
ACT-PETR	.COM-PETRX	47.900	CET					52.289	53.616	
ACT-CHEM	.COM-CHEMD	83.100	CET					75.520	82.264	
ACT-CHEM	.COM-CHEMX	32.500	CET					32.771	32.849	
ACT-MAN	.COM-MAND	129.200	CET					106.430	118.837	
ACT-MAN	.COM-MANX	13.700	CET					13.146	12.992	
ACT-CONS	.COM-CONSD	162.300	CET					126.985	139.332	
ACT-PSRV	.COM-PSRVD	488.100	CET					480.280	494.202	

685 PARAMETER CT CELL TABLE

+	A-USED	B-USED	BETA-USED	FQ-USED	FV-USED	WP-USED	THETA-USED
ACT-CONS .COM-CONSD		1.000					
ACT-PSRV .COM-PSRVD		0.744					
ACT-PSRV .COM-PSRVX		0.256					
ACT-GSRV .COM-GSRVD		0.996					
ACT-GSRV .COM-GSRVX		0.004					
COM-AGRD .COM-AGRC	0.975						
COM-FOODD.COM-FOODC	0.938						
COM-COND .COM-CONC	0.715						
COM-PETRD.COM-PETRC	0.419						
COM-CHEMD.COM-CHEMC	0.578						
COM-MAND .COM-MANC	0.446						
COM-CONSD.COM-CONSC	1.000						
COM-PSRVD.COM-PSRVC	0.909						
COM-GSRVD.COM-GSRVC	0.966						
COM-AGRM .COM-AGRC	0.025						
COM-FOODM.COM-FOODC	0.062						
COM-CONM .COM-CONC	0.285						
COM-PETRM.COM-PETRC	0.581						
COM-CHEMM.COM-CHEMC	0.422						
COM-MANM .COM-MANC	0.554						
COM-PSRVM.COM-PSRVC	0.091						
COM-GSRVM.COM-GSRVC	0.034						
COM-AGRC .RHSDC			0.570				
COM-AGRC .UHSDC			0.080				
COM-AGRC .SAV-INV	0.136						
COM-AGRC .ACT-AGR	0.050						
COM-AGRC .ACT-FOOD	0.339						
COM-AGRC .ACT-CON	0.032						
COM-AGRC .ACT-CHEM	0.069						
COM-AGRC .ACT-MAN	6.9979E-4						
COM-AGRC .ACT-PSRV	7.6196E-4						
COM-AGRC .ACT-GSRV	0.002						
COM-FOODC.RHSDC			0.100				
COM-FOODC.UHSDC			0.120				
COM-FOODC.SAV-INV	0.004						
COM-FOODC.ACT-AGR	0.010						
COM-FOODC.ACT-FOOD	0.272						
COM-FOODC.ACT-CON	0.022						
COM-FOODC.ACT-CHEM	0.127						
COM-FOODC.ACT-MAN	0.003						
COM-FOODC.ACT-PSRV	0.069						
COM-FOODC.ACT-GSRV	0.083						
COM-CONC .RHSDC			0.100				
COM-CONC .UHSDC			0.180				
COM-CONC .SAV-INV	0.019						
COM-CONC .ACT-AGR	0.010						
COM-CONC .ACT-FOOD	0.036						
COM-CONC .ACT-CON	0.380						
COM-CONC .ACT-PETR	0.005						
COM-CONC .ACT-CHEM	0.031						
COM-CONC .ACT-MAN	0.022						
COM-CONC .ACT-CONS	0.034						

685 PARAMETER CT CELL TABLE

	TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
ACT-PSRV .COM-PSRVX	168.100	CET					170.137	171.164	
ACT-GSRV .COM-GSRVD	268.000	CET					268.457	274.441	
ACT-GSRV .COM-GSRVX	1.200	CET					1.191	1.227	
COM-AGRD .COM-AGRC	474.300	CES					469.017	473.962	
COM-FOODD.COM-FOODC	326.900	CES					314.418	326.723	
COM-COND .COM-CONC	131.900	CES					116.308	127.617	
COM-PETRD.COM-PETRC	92.100	CES					77.650	97.899	
COM-CHEMD.COM-CHEMC	91.000	CES					82.699	90.084	
COM-MAND .COM-MANC	151.200	CES					124.553	139.073	
COM-CONSD.COM-CONSC	162.700	CES					127.298	139.675	
COM-PSRVD.COM-PSRVC	502.900	CES					494.842	509.187	
COM-GSRVD.COM-GSRVC	268.500	CES					268.958	274.953	
COM-AGRM .COM-AGRC	12.200	CES					12.665	13.436	
COM-FOODM.COM-FOODC	21.600	CES					22.578	27.709	
COM-CONM .COM-CONC	52.700	CES					50.235	64.413	
COM-PETRM.COM-PETRC	127.500	CES					109.995	129.615	
COM-CHEMM.COM-CHEMC	66.400	CES					60.358	65.701	
COM-MANM .COM-MANC	188.000	CES					153.105	176.805	
COM-PSRVM.COM-PSRVC	50.200	CES					50.107	50.107	
COM-GSRVM.COM-GSRVC	9.500	CES					9.469	9.777	
COM-AGRC .RHSDC	262.900	LES			186.121	0.570	269.068	272.245	
COM-AGRC .UHSDC	29.900	LES			20.907	0.080	30.691	31.053	
COM-AGRC .SAV-INV	39.900	VSHR					29.791	30.143	
COM-AGRC .ACT-AGR	31.600	CES2		EPS			31.251	31.620	
COM-AGRC .ACT-FOOD	108.700	CES2		EPS			107.661	108.932	
COM-AGRC .ACT-CON	4.400	CES2		EPS			4.246	4.296	
COM-AGRC .ACT-PETR		CES2		EPS					
COM-AGRC .ACT-CHEM	8.000	CES2		EPS			7.875	7.968	
COM-AGRC .ACT-MAN	0.100	CES2		EPS			0.091	0.092	
COM-AGRC .ACT-CONS		CES2		EPS					
COM-AGRC .ACT-PSRV	0.500	CES2		EPS			0.501	0.507	
COM-AGRC .ACT-GSRV	0.500	CES2		EPS			0.506	0.512	
COM-FOODC.RHSDC	105.800	LES			92.330	0.100	102.838	108.015	
COM-FOODC.UHSDC	62.300	LES			48.811	0.120	61.513	64.610	
COM-FOODC.SAV-INV	1.200	VSHR					0.896	0.941	
COM-FOODC.ACT-AGR	6.000	CES2		EPS			5.716	6.004	
COM-FOODC.ACT-FOOD	87.100	CES2		EPS			83.103	87.286	
COM-FOODC.ACT-CON	3.000	CES2		EPS			2.789	2.929	
COM-FOODC.ACT-PETR		CES2		EPS					
COM-FOODC.ACT-CHEM	14.700	CES2		EPS			13.939	14.641	
COM-FOODC.ACT-MAN	0.500	CES2		EPS			0.439	0.461	
COM-FOODC.ACT-CONS		CES2		EPS					
COM-FOODC.ACT-PSRV	45.500	CES2		EPS			43.925	46.136	
COM-FOODC.ACT-GSRV	22.400	CES2		EPS			21.839	22.938	
COM-CONC .RHSDC	37.900	LES			24.430	0.100	36.203	41.582	
COM-CONC .UHSDC	37.800	LES			17.566	0.180	37.856	43.481	
COM-CONC .SAV-INV	5.700	VSHR					4.256	4.888	
COM-CONC .ACT-AGR	6.200	CES2		EPS			5.401	6.204	
COM-CONC .ACT-FOOD	11.700	CES2		EPS			10.208	11.725	
COM-CONC .ACT-CON	52.600	CES2		EPS			44.711	51.354	
COM-CONC .ACT-PETR	0.700	CES2		EPS			0.661	0.759	
COM-CONC .ACT-CHEM	3.600	CES2		EPS			3.122	3.585	

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	TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
COM-CONC .ACT-MAN	3.200	CES2		EPS			2.571	2.953	
COM-CONC .ACT-CONS	5.500	CES2		EPS			4.111	4.722	
COM-CONC .ACT-PSRV	13.800	CES2		EPS			12.183	13.993	
COM-CONC .ACT-GSRV	5.900	CES2		EPS			5.260	6.042	
COM-PETRC.RHSDC	4.200	LES			4.200	EPS	3.465	4.200	
COM-PETRC.UHSDC	3.900	LES			1.652	0.020	3.870	4.690	
COM-PETRC.SAV-INV	0.100	VSHR					0.075	0.090	
COM-PETRC.ACT-AGR	5.000	CES2		EPS			4.128	5.003	
COM-PETRC.ACT-FOOD	5.400	CES2		EPS			4.465	5.412	
COM-PETRC.ACT-CON	3.700	CES2		EPS			2.980	3.612	
COM-PETRC.ACT-PETR	117.200	CES2		EPS			104.877	127.113	
COM-PETRC.ACT-CHEM	9.700	CES2		EPS			7.971	9.661	
COM-PETRC.ACT-MAN	4.600	CES2		EPS			3.502	4.244	
COM-PETRC.ACT-CONS	21.700	CES2		EPS			15.370	18.629	
COM-PETRC.ACT-PSRV	38.300	CES2		EPS			32.042	38.835	
COM-PETRC.ACT-GSRV	5.800	CES2		EPS			4.900	5.939	
COM-CHEMC.RHSDC	22.300	LES			16.912	0.040	21.504	23.417	
COM-CHEMC.UHSDC	21.500	LES			15.879	0.050	20.849	22.704	
COM-CHEMC.ACT-AGR	17.000	CES2		EPS			15.621	17.011	
COM-CHEMC.ACT-FOOD	13.100	CES2		EPS			12.055	13.128	
COM-CHEMC.ACT-CON	10.300	CES2		EPS			9.235	10.056	
COM-CHEMC.ACT-PETR	2.100	CES2		EPS			2.092	2.278	
COM-CHEMC.ACT-CHEM	29.100	CES2		EPS			26.614	28.982	
COM-CHEMC.ACT-MAN	11.500	CES2		EPS			9.744	10.611	
COM-CHEMC.ACT-CONS	21.600	CES2		EPS			17.028	18.543	
COM-CHEMC.ACT-PSRV	5.900	CES2		EPS			5.494	5.982	
COM-CHEMC.ACT-GSRV	3.000	CES2		EPS			2.821	3.072	
COM-MANC .RHSDC	14.800	LES			9.412	0.040	14.247	16.207	
COM-MANC .UHSDC	33.300	LES			22.059	0.100	31.927	36.318	
COM-MANC .SAV-INV	126.000	VSHR					94.077	107.017	
COM-MANC .ACT-AGR	3.000	CES2		EPS			2.639	3.002	
COM-MANC .ACT-FOOD	11.000	CES2		EPS			9.691	11.024	
COM-MANC .ACT-CON	8.200	CES2		EPS			7.038	8.006	
COM-MANC .ACT-PETR	1.200	CES2		EPS			1.144	1.301	
COM-MANC .ACT-CHEM	6.300	CES2		EPS			5.516	6.275	
COM-MANC .ACT-MAN	67.000	CES2		EPS			54.345	61.820	
COM-MANC .ACT-CONS	29.100	CES2		EPS			21.961	24.982	
COM-MANC .ACT-PSRV	34.500	CES2		EPS			30.753	34.982	
COM-MANC .ACT-GSRV	4.800	CES2		EPS			4.321	4.915	
COM-CONSC.RHSDC	0.100	LES			0.100	EPS	0.091	0.100	
COM-CONSC.UHSDC	0.300	LES			0.300	EPS	0.273	0.300	
COM-CONSC.SAV-INV	114.000	VSHR					85.118	93.394	
COM-CONSC.ACT-AGR		CES2		EPS					
COM-CONSC.ACT-FOOD	1.200	CES2		EPS			1.096	1.203	
COM-CONSC.ACT-CON	0.800	CES2		EPS			0.712	0.781	
COM-CONSC.ACT-PETR	0.500	CES2		EPS			0.494	0.542	
COM-CONSC.ACT-CHEM	0.700	CES2		EPS			0.635	0.697	
COM-CONSC.ACT-MAN	0.700	CES2		EPS			0.589	0.646	
COM-CONSC.ACT-CONS	20.500	CES2		EPS			16.039	17.599	
COM-CONSC.ACT-PSRV	6.000	CES2		EPS			5.545	6.084	
COM-CONSC.ACT-GSRV	17.900	CES2		EPS			16.706	18.330	
COM-PSRVC.RHSDC.	82.300	LES			63.442	0.140	82.722	84.898	

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	TBASE	SPECS	ETA	SIGMAC	ALPHA	BETA	TSOL	QCSOL	THETA
COM-PSRVC.UHSDC	171.300	LES			126.336	0.400	173.237	177.794	
COM-PSRVC.SAV-INV	7.300	VSHR					5.451	5.594	
COM-PSRVC.ACT-AGR	14.600	CES2		EPS			14.235	14.609	
COM-PSRVC.ACT-FOOD	28.600	CES2		EPS			27.927	28.661	
COM-PSRVC.ACT-CON	19.300	CES2		EPS			18.360	18.843	
COM-PSRVC.ACT-PETR	3.100	CES2		EPS			3.276	3.362	
COM-PSRVC.ACT-CHEM	9.900	CES2		EPS			9.607	9.860	
COM-PSRVC.ACT-MAN	17.000	CES2		EPS			15.284	15.686	
COM-PSRVC.ACT-CONS	17.700	CES2		EPS			14.806	15.195	
COM-PSRVC.ACT-PSRV	158.400	CES2		EPS			156.498	160.615	
COM-PSRVC.ACT-GSRV	23.600	CES2		EPS			23.548	24.167	
COM-GSRVC.RHSDC	8.500	LES			7.153	0.010	8.488	8.680	
COM-GSRVC.UHSDC	14.400	LES			8.779	0.050	14.853	15.189	
COM-GSRVC.GOVTC	253.800	VEXO					253.800	259.545	
COM-GSRVC.SAV-INV		VSHR							
COM-GSRVC.ACT-AGR	0.300	CES2		EPS			0.294	0.300	
COM-GSRVC.ACT-FOOD	0.400	CES2		EPS			0.392	0.401	
COM-GSRVC.ACT-CON		CES2		EPS					
COM-GSRVC.ACT-PETR		CES2		EPS					
COM-GSRVC.ACT-CHEM		CES2		EPS					
COM-GSRVC.ACT-MAN		CES2		EPS					
COM-GSRVC.ACT-CONS		CES2		EPS					
COM-GSRVC.ACT-PSRV		CES2		EPS					
COM-GSRVC.ACT-GSRV	0.600	CES2		EPS			0.601	0.614	
COM-AGRX .RES-WRD	153.900	EXPORT	1.500				154.145	154.636	
COM-FOODX.RES-WRD	36.200	EXPORT	3.000				36.750	37.027	
COM-CONX .RES-WRD	18.200	EXPORT	4.500				18.649	18.779	
COM-PETRX.RES-WRD	47.900	EXPORT	4.500				52.289	53.616	
COM-CHEMX.RES-WRD	32.500	EXPORT	4.500				32.771	32.849	
COM-MANX .RES-WRD	13.700	EXPORT	4.500				13.146	12.992	
COM-PSRVX.RES-WRD	168.100	EXPORT	3.000				170.137	171.164	
COM-GSRVX.RES-WRD	1.200	EXPORT	0.750				1.191	1.227	
RES-WRD .SLBRT	12.400	IDIST					12.416		
RES-WRD .CAPITALT	70.000	IDIST					70.400		
RES-WRD .RHSDY	1.800	IDIST					1.799		
RES-WRD .UHSDY	11.400	IDIST					11.411		
RES-WRD .COMPY	7.300	IDIST					7.339		
RES-WRD .GOVTY	3.200	FEXO					3.200		
RES-WRD .COM-AGRM	11.500	IMPORT					12.665	12.665	
RES-WRD .COM-FOODM	17.600	IMPORT					22.578	22.578	
RES-WRD .COM-CONM	41.100	IMPORT					50.235	50.235	
RES-WRD .COM-PETRM	108.200	IMPORT					109.995	109.995	
RES-WRD .COM-CHEMM	61.000	IMPORT					60.358	60.358	
RES-WRD .COM-MANM	162.800	IMPORT					153.105	153.105	
RES-WRD .COM-PSRVM	50.200	IMPORT					50.107	50.107	
RES-WRD .COM-GSRVM	9.200	IMPORT					9.469	9.469	

685 PARAMETER CT CELL TABLE

	+	A-USED	B-USED	BETA-USED	FQ-USED	FV-USED	WP-USED	THETA-USED
ULBRD	.AGL-AG	0.980						
ULBRD	.AGL-FOD	0.376						
ULBRD	.AGL-CON	0.445						
ULBRD	.AGL-PTR	0.296						
ULBRD	.AGL-CEM	0.242						
ULBRD	.AGL-MAN	0.335						
ULBRD	.AGL-CNS	0.371						
ULBRD	.AGL-PSR	0.403						
ULBRD	.AGL-GSR	0.208						
SLBRD	.AGL-AG	0.020						
SLBRD	.AGL-FOD	0.624						
SLBRD	.AGL-CON	0.555						
SLBRD	.AGL-PTR	0.704						
SLBRD	.AGL-CEM	0.758						
SLBRD	.AGL-MAN	0.665						
SLBRD	.AGL-CNS	0.629						
SLBRD	.AGL-PSR	0.597						
SLBRD	.AGL-GSR	0.792						
AGL-AG	.ACT-AGR	0.611						
AGL-FOD	.ACT-FOOD	0.068						
AGL-CON	.ACT-CON	0.166						
AGL-PTR	.ACT-PETR	0.020						
AGL-CEM	.ACT-CHEM	0.111						
AGL-MAN	.ACT-MAN	0.167						
AGL-CNS	.ACT-CONS	0.241						
AGL-PSR	.ACT-PSRV	0.324						
AGL-GSR	.ACT-GSRV	0.679						
CAP-AGR	.ACT-AGR	0.256						
CAP-FOOD	.ACT-FOOD	0.099						
CAP-CON	.ACT-CON	0.095						
CAP-PETR	.ACT-PETR	0.044						
CAP-CHEM	.ACT-CHEM	0.180						
CAP-MAN	.ACT-MAN	0.101						
CAP-CONS	.ACT-CONS	0.044						
CAP-PSRV	.ACT-PSRV	0.214						
CAP-GSRV,	.ACT-GSRV	0.007						
SLBRF	.RES-WRD					1.800		
CAPITALF	.RES-WRD					12.500		
ULBRT	.ULBRD	1.000						
SLBRT	.SLBRD	1.000						
SLBRT	.SLBRF	1.000						
CAPITALT	.CAP-AGR	1.000						
CAPITALT	.CAP-FOOD	1.000						
CAPITALT	.CAP-CON	1.000						
CAPITALT	.CAP-PETR	1.000						
CAPITALT	.CAP-CHEM	1.000						
CAPITALT	.CAP-MAN	1.000						
CAPITALT	.CAP-CONS	1.000						
CAPITALT	.CAP-PSRV	1.000						
CAPITALT	.CAP-GSRV	1.000						
CAPITALT	.CAPITALF	1.000						
RHSDY	.ULBRT	0.759						

685 PARAMETER CT CELL TABLE

	+	A-USED	B-USED	BETA-USED	FQ-USED	FV-USED	WP-USED	THETA-USED
RHSDY	.SLBRT	0.271						
RHSDY	.CAPITALT	0.036						
RHSDY	.RHSDY	0.009						
RHSDY	.UHSDY	0.023						
RHSDY	.COMPY	0.237						
RHSDY	.GOVTY					4.300		
RHSDY	.RES-WRD					3.400		
RHSDC	.RHSDY	0.849						
UHSDY	.ULBRT	0.241						
UHSDY	.SLBRT	0.694						
UHSDY	.COMPY	0.212						
UHSDY	.GOVTY					4.600		
UHSDY	.RES-WRD					1.900		
UHSDC	.UHSDY	0.806						
COMPY	.CAPITALT	0.787						
COMPY	.RHSDY	0.005						
COMPY	.UHSDY	0.008						
COMPY	.COMPY	0.045						
COMPY	.GOVTY					12.300		
COMPY	.RES-WRD					8.000		
GOVTY	.CAPITALT	0.005						
GOVTY	.RHSDY	0.059						
GOVTY	.UHSDY	0.096						
GOVTY	.COMPY	0.218						
GOVTY	.GOVTY					7.300		
GOVTY	.IND-TX	1.000						
GOVTY	.RES-WRD					16.500		
SAV-INV	.RHSDY	0.076						
SAV-INV	.UHSDY	0.042						
SAV-INV	.COMPY	0.267						
SAV-INV	.RES-WRD					51.900		
IND-TX	.COM-AGRD							0.005
IND-TX	.COM-FOODD							0.149
IND-TX	.COM-COND							0.098
IND-TX	.COM-PETRD							0.078
IND-TX	.COM-CHEMD							0.095
IND-TX	.COM-MAND							0.170
IND-TX	.COM-CONSD							0.002
IND-TX	.COM-PSRVD							0.030
IND-TX	.COM-GSRVD							0.002
ACT-AGR	.COM-AGRD		0.754					
ACT-AGR	.COM-AGRX		0.246					
ACT-FOOD	.COM-FOODD		0.887					
ACT-FOOD	.COM-FOODX		0.113					
ACT-CON	.COM-COND		0.868					
ACT-CON	.COM-CONX		0.132					
ACT-PETR	.COM-PETRD		0.641					
ACT-PETR	.COM-PETRX		0.359					
ACT-CHEM	.COM-CHEMD		0.719					
ACT-CHEM	.COM-CHEMX		0.281					
ACT-MAN	.COM-MAND		0.904					
ACT-MAN	.COM-MANX		0.096					

685 PARAMETER CT CELL TABLE

+	A-USED	B-USED	BETA-USED	FQ-USED	FV-USED	WP-USED	THETA-USED
COM-CONC .ACT-PSRV	0.021						
COM-CONC .ACT-GSRV	0.022						
COM-PETRC.UHSDC			0.020				
COM-PETRC.SAV-INV	3.3990E-4						
COM-PETRC.ACT-AGR	0.008						
COM-PETRC.ACT-FOOD	0.017						
COM-PETRC.ACT-CON	0.027						
COM-PETRC.ACT-PETR	0.879						
COM-PETRC.ACT-CHEM	0.084						
COM-PETRC.ACT-MAN	0.032						
COM-PETRC.ACT-CONS	0.134						
COM-PETRC.ACT-PSRV	0.058						
COM-PETRC.ACT-GSRV	0.022						
COM-CHEMC.RHSDC			0.040				
COM-CHEMC.UHSDC			0.050				
COM-CHEMC.ACT-AGR	0.027						
COM-CHEMC.ACT-FOOD	0.041						
COM-CHEMC.ACT-CON	0.074						
COM-CHEMC.ACT-PETR	0.016						
COM-CHEMC.ACT-CHEM	0.252						
COM-CHEMC.ACT-MAN	0.080						
COM-CHEMC.ACT-CONS	0.133						
COM-CHEMC.ACT-PSRV	0.009						
COM-CHEMC.ACT-GSRV	0.011						
COM-MANC .RHSDC			0.040				
COM-MANC .UHSDC			0.100				
COM-MANC .SAV-INV	0.428						
COM-MANC .ACT-AGR	0.005						
COM-MANC .ACT-FOOD	0.034						
COM-MANC .ACT-CON	0.059						
COM-MANC .ACT-PETR	0.009						
COM-MANC .ACT-CHEM	0.054						
COM-MANC .ACT-MAN	0.469						
COM-MANC .ACT-CONS	0.179						
COM-MANC .ACT-PSRV	0.053						
COM-MANG .ACT-GSRV	0.018						
COM-CONSC.SAV-INV	0.387						
COM-CONSC.ACT-FOOD	0.004						
COM-CONSC.ACT-CON	0.006						
COM-CONSC.ACT-PETR	0.004						
COM-CONSC.ACT-CHEM	0.006						
COM-CONSC.ACT-MAN	0.005						
COM-CONSC.ACT-CONS	0.126						
COM-CONSC.ACT-PSRV	0.009						
COM-CONSC.ACT-GSRV	0.066						
COM-PSRVC.RHSDC			0.140				
COM-PSRVC.UHSDC			0.400				
COM-PSRVC.SAV-INV	0.025						
COM-PSRVC.ACT-AGR	0.023						
COM-PSRVC.ACT-FOOD	0.089						
COM-PSRVC.ACT-CON	0.140						
COM-PSRVC.ACT-PETR	0.023						

685 PARAMETER CT CELL TABLE

+	A-USED	B-USED	BETA-USED	FQ-USED	FV-USED	WP-USED	THETA-USED
COM-PSRVC.ACT-CHEM	0.086						
COM-PSRVC.ACT-MAN	0.119						
COM-PSRVC.ACT-CONS	0.109						
COM-PSRVC.ACT-PSRV	0.241						
COM-PSRVC.ACT-GSRV	0.088						
COM-GSRVC.RHSDC			0.010				
COM-GSRVC.UHSDC			0.050				
COM-GSRVC.GOVTC				253.800			
COM-GSRVC.ACT-AGR	4.7939E-4						
COM-GSRVC.ACT-FOOD	0.001						
COM-GSRVC.ACT-GSRV	0.002						
COM-AGRX .RES-WRD				153.900		1.000	
COM-FOODX.RES-WRD				36.200		1.000	
COM-CONX .RES-WRD				18.200		1.000	
COM-PETRX.RES-WRD				47.900		1.000	
COM-CHEMX.RES-WRD				32.500		1.000	
COM-MANX .RES-WRD				13.700		1.000	
COM-PSRVX.RES-WRD				168.100		1.000	
COM-GSRVX.RES-WRD				1.200		1.000	
RES-WRD .SLBRT	0.034						
RES-WRD .CAPITALT	0.172						
RES-WRD .RHSDY	0.003						
RES-WRD .UHSDY	0.025						
RES-WRD .COMPY	0.020						
RES-WRD .GOVTY					3.200		
RES-WRD .COM-AGRM						1.000	
RES-WRD .COM-FOODM						1.000	
RES-WRD .COM-CONM						1.000	
RES-WRD .COM-PETRM						1.000	
RES-WRD .COM-CHEMM						1.000	
RES-WRD .COM-MANM						1.000	
RES-WRD .COM-PSRVM						1.000	
RES-WRD .COM-GSRVM						1.000	

**** FILE SUMMARY FOR USER ECRPP

INPUT	KTLM	GAMS	A
OUTPUT	KTLM	LISTING	A

EXECUTION TIME = 5.440 SECONDS

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1294.308	1296.123	0.999
NET INDIRECT TAXES	175.500	138.363	175.989	
INCOME EFFECT			-0.440	
FINAL USE	1461.500	1422.559	1459.499	0.975
EXPORTS	471.700	474.885	476.946	0.996
IMPORTS	-461.600	-464.773	-464.773	1.000
GDP AT MARKET PRICES	1471.600	1432.671	1471.672	0.973
TERMS OF TRADE			-2.061	
GROSS DOMESTIC INCOME	1471.600	1432.671	1469.611	
RESOURCE GAP	-10.100	-10.112	-10.112	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 6

SOLUTION TIME 6.377 SECONDS

WORK SPACE NEEDED -- 8352 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	0.996	543.400	541.446	543.400	
SLBRD	1.000	357.723	357.723	357.700	
AGL-AG	0.996	382.178	380.830	382.200	
AGL-FOD	0.999	21.890	21.860	21.800	
AGL-CON	0.998	22.672	22.636	22.900	
AGL-PTR	0.999	3.062	3.059	2.700	
AGL-CEM	0.999	12.764	12.753	12.800	
AGL-MAN	0.999	22.552	22.525	23.900	
AGL-CNS	0.999	36.023	35.975	39.100	
AGL-PSR	0.999	214.955	214.643	212.900	
AGL-GSR	0.999	185.027	184.888	182.800	
CAP-AGR	0.996	159.900	159.324	159.900	
CAP-FOOD	1.004	31.600	31.731	31.600	
CAP-CON	0.985	13.100	12.906	13.100	
CAP-PETR	1.182	5.800	6.853	5.800	
CAP-CHEM	0.993	20.800	20.665	20.800	
CAP-MAN	0.919	14.400	13.238	14.400	
CAP-CONS	0.848	7.100	6.018	7.100	
CAP-PSRV	1.015	140.400	142.459	140.400	
CAP-GSRV	1.024	1.900	1.945	1.900	
SLBRF			1.800	1.800	
CAPITALF			12.500	12.500	
ULBRT			541.446	543.400	
SLBRT			359.523	359.500	
CAPITALT			407.639	407.500	
RHSDY			633.530	635.000	
RHSDC	0.980	548.564	537.553	538.800	-0.042

UHSDY			464.266	464.700	
UHSDC	0.973	384.740	374.350	374.700	-0.055
COMPY			364.503	364.400	
GOVTY			325.758	363.000	
GOVTC	0.988	256.782	253.800	253.800	
SAV-INV	0.954	269.273	256.856	294.200	-0.044
IND-TX			138.364	175.500	
ACT-AGR	0.993	625.774	621.510	625.800	-0.002
ACT-FOOD	0.982	321.140	315.228	320.600	-0.003
ACT-CON	0.962	137.424	132.267	138.300	-0.010
ACT-PETR	0.928	138.661	128.652	133.300	-0.061
ACT-CHEM	0.971	115.475	112.079	115.600	-0.005
ACT-MAN	0.954	137.793	131.422	142.900	-0.026
ACT-CONS	0.955	151.358	144.614	162.300	-0.038
ACT-PSRV	0.987	660.005	651.465	656.200	-0.008
ACT-GSRV	0.989	272.445	269.318	269.200	
COM-AGRD	0.992	473.747	469.813	474.300	
COM-FOODD	0.980	326.994	320.377	326.900	
COM-COND	0.957	130.541	124.975	131.900	
COM-PETRD	0.894	94.912	84.825	92.100	
COM-CHEMD	0.960	90.642	86.976	91.000	
COM-MAND	0.948	145.586	138.055	151.200	
COM-CONSD	0.955	151.731	144.970	162.700	
COM-PSRVD	0.984	505.471	497.573	502.900	
COM-GSRVD	0.989	271.737	268.622	268.500	
COM-AGRM	0.971	12.703	12.338	12.200	
COM-FOODM	0.907	24.241	21.997	21.600	
COM-CONM	0.890	58.194	51.790	52.700	
COM-PETRM	0.924	128.506	118.780	127.500	
COM-CHEMM	0.959	66.149	63.459	66.400	
COM-MANM	0.933	182.973	170.710	188.000	
COM-PSRVM	1.000	50.061	50.061	50.200	
COM-GSRVM	0.984	9.636	9.484	9.500	
COM-AGRC	0.991	486.444	482.152	486.500	-0.005
COM-FOODC	0.975	351.141	342.374	348.500	-0.094
COM-CONC	0.937	188.578	176.764	184.600	-0.157
COM-PETRC	0.911	223.398	203.605	219.600	-0.020
COM-CHEMC	0.959	156.791	150.435	157.400	
COM-MANC	0.940	328.551	308.765	339.200	-0.007
COM-CONSC	0.955	151.731	144.970	162.700	
COM-PSRVC	0.986	555.529	547.634	553.100	-0.003
COM-GSRVC	0.988	281.373	278.106	278.000	
COM-AGRX	0.998	154.423	154.074	153.900	
COM-FOODX	0.996	36.655	36.503	36.200	
COM-CONX	0.996	18.552	18.473	18.200	
COM-PETRX	0.988	50.613	49.997	47.900	
COM-CHEMX	0.999	32.697	32.653	32.500	
COM-MANX	1.005	13.385	13.454	13.700	
COM-PSRVX	0.995	169.407	168.535	168.100	
COM-GSRVX	0.985	1.213	1.196	1.200	
RES-WRD	1.000		570.885	567.700	

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1486.145	1316.315	1.129
NET INDIRECT TAXES	175.500	211.284	181.127	
INCOME EFFECT			-2.081	
FINAL USE	1461.500	1689.288	1480.780	1.141
EXPORTS	471.700	576.139	487.913	1.181
IMPORTS	-461.600	-567.998	-473.332	1.200
GDP AT MARKET PRICES	1471.600	1697.429	1495.362	1.135
TERMS OF TRADE			-7.797	
GROSS DOMESTIC INCOME	1471.600	1697.429	1487.565	
RESOURCE GAP	-10.100	-8.141	-6.784	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 8

SOLUTION TIME 6.606 SECONDS

WORK SPACE NEEDED -- 8352 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	1.178	543.400	639.862	543.400	
SLBRD	1.000	377.915	377.915	357.700	
AGL-AG	1.174	388.842	456.397	382.200	-0.093
AGL-FOD	1.064	22.384	23.826	21.800	-0.048
AGL-CON	1.077	24.482	26.357	22.900	-0.056
AGL-PTR	1.051	3.069	3.225	2.700	-0.005
AGL-CEM	1.042	14.253	14.846	12.800	-0.017
AGL-MAN	1.058	27.592	29.182	23.900	-0.046
AGL-CNS	1.064	45.168	48.045	39.100	-0.088
AGL-PSR	1.069	222.406	237.801	212.900	-0.492
AGL-GSR	1.035	172.016	178.099	182.800	-0.258
CAP-AGR	1.201	159.900	192.041	159.900	
CAP-FOOD	1.103	31.600	34.843	31.600	
CAP-CON	1.177	13.100	15.417	13.100	
CAP-PETR	1.246	5.800	7.230	5.800	
CAP-CHEM	1.291	20.800	26.863	20.800	
CAP-MAN	1.299	14.400	18.699	14.400	
CAP-CONS	1.419	7.100	10.078	7.100	
CAP-PSRV	1.150	140.400	161.455	140.400	
CAP-GSRV	0.917	1.900	1.742	1.900	
SLBRF			2.160	1.800	
CAPITALF			15.000	12.500	
ULBRT			639.862	543.400	
SLBRT			380.075	359.500	
CAPITALT			483.368	407.500	
RHSDY			734.717	635.000	
RHSDC	1.158	538.378	623.411	538.800	-0.056

UHSDY			516.500	464.700	
UHSDC	1.135	366.824	416.468	374.700	-0.076
COMPY			429.582	364.400	
GOVTY			427.553	363.000	
GOVTC	1.072	236.676	253.800	253.800	
SAV-INV	1.168	338.734	395.609	294.200	-0.036
IND-TX			211.284	175.500	
ACT-AGR	1.179	633.442	747.024	625.800	-0.026
ACT-FOOD	1.147	324.070	371.835	320.600	-0.023
ACT-CON	1.143	144.278	164.841	138.300	-0.036
ACT-PETR	1.195	138.756	165.853	133.300	-0.021
ACT-CHEM	1.175	120.269	141.267	115.600	-0.096
ACT-MAN	1.163	156.138	181.638	142.900	-0.144
ACT-CONS	1.153	183.119	211.116	162.300	-0.141
ACT-PSRV	1.118	673.599	753.413	656.200	-0.200
ACT-GSRV	1.069	253.474	270.897	269.200	-0.010
COM-AGRD	1.177	479.359	564.163	474.300	
COM-FOODD	1.142	329.364	376.273	326.900	
COM-COND	1.136	137.052	155.752	131.900	
COM-PETRD	1.198	95.933	114.970	92.100	
COM-CHEMD	1.169	94.564	110.551	91.000	
COM-MAND	1.162	165.159	191.912	151.200	
COM-CONSD	1.153	183.570	211.636	162.700	
COM-PSRVD	1.100	514.144	565.806	502.900	
COM-GSRVD	1.068	252.769	269.949	268.500	
COM-AGRM	1.200	11.860	14.232	12.200	
COM-FOODM	1.200	20.215	24.259	21.600	
COM-CONM	1.200	50.466	60.560	52.700	
COM-PETRM	1.200	132.692	159.230	127.500	
COM-CHEMM	1.200	67.821	81.385	66.400	
COM-MANM	1.200	201.039	241.247	188.000	
COM-PSRVM	1.200	49.148	58.978	50.200	
COM-GSRVM	1.200	8.437	10.124	9.500	
COM-AGRC	1.177	491.215	578.395	486.500	-0.004
COM-FOODC	1.146	349.544	400.532	348.500	-0.036
COM-CONC	1.154	187.435	216.312	184.600	-0.084
COM-PETRC	1.199	228.625	274.200	219.600	
COM-CHEMC	1.182	162.376	191.936	157.400	-0.009
COM-MANC	1.183	366.168	433.160	339.200	-0.031
COM-CONSC	1.153	183.570	211.636	162.700	
COM-PSRVC	1.109	563.205	624.784	553.100	-0.087
COM-GSRVC	1.072	261.176	280.073	278.000	-0.029
COM-AGRX	1.187	156.505	185.716	153.900	
COM-FOODX	1.186	37.509	44.481	36.200	
COM-CONX	1.182	19.477	23.023	18.200	
COM-PETRX	1.190	49.802	59.247	47.900	
COM-CHEMX	1.189	33.914	40.313	32.500	
COM-MANX	1.176	15.009	17.650	13.700	
COM-PSRVX	1.170	174.524	204.258	168.100	
COM-GSRVX	1.238	1.172	1.451	1.200	
RES-WRD	1.200		691.339	567.700	

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1485.466	1315.331	1.129
NET INDIRECT TAXES	175.500	57.592	177.904	
INCOME EFFECT			-4.519	
FINAL USE	1461.500	1516.124	1443.166	1.051
EXPORTS	471.700	493.200	511.816	0.964
IMPORTS	-461.600	-466.266	-466.266	1.000
GDP AT MARKET PRICES	1471.600	1543.058	1488.716	1.037
TERMS OF TRADE			-18.616	
GROSS DOMESTIC INCOME	1471.600	1543.058	1470.100	
RESOURCE GAP	-10.100	-26.933	-26.933	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 13

SOLUTION TIME 7.475 SECONDS

WORK SPACE NEEDED -- 8732 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	1.170	543.400	635.638	543.400	
SLBRD	1.000	376.931	376.931	357.700	
AGL-AG	1.166	389.641	454.374	382.200	-0.085
AGL-FOD	1.062	23.732	25.196	21.800	-0.047
AGL-CON	1.073	25.708	27.594	22.900	-0.054
AGL-PTR	1.049	4.526	4.746	2.700	-0.007
AGL-CEM	1.040	13.959	14.516	12.800	-0.016
AGL-MAN	1.055	21.551	22.740	23.900	-0.033
AGL-CNS	1.061	31.242	33.147	39.100	-0.056
AGL-PSR	1.066	229.741	244.969	212.900	-0.467
AGL-GSR	1.034	179.216	185.287	182.800	-0.248
CAP-AGR	1.197	159.900	191.321	159.900	
CAP-FOOD	1.189	31.600	37.572	31.600	
CAP-CON	1.252	13.100	16.406	13.100	
CAP-PETR	2.088	5.800	12.112	5.800	
CAP-CHEM	1.237	20.800	25.724	20.800	
CAP-MAN	0.910	14.400	13.107	14.400	
CAP-CONS	0.677	7.100	4.809	7.100	
CAP-PSRV	1.211	140.400	169.959	140.400	
CAP-GSRV	0.994	1.900	1.888	1.900	
SLBRF			1.800	1.800	
CAPITALF			12.500	12.500	
ULBRT			635.638	543.400	
SLBRT			378.731	359.500	
CAPITALT			485.397	407.500	
RHSDY			730.439	635.000	
RHSDC	1.087	570.392	619.780	538.800	-0.343

UHSDY			514.158	464.700	
UHSDC	1.037	399.615	414.579	374.700	-0.142
COMPY			429.539	364.400	
GOVTY			270.083	363.000	
GOVTC	1.029	246.719	253.800	253.800	
SAV-INV	1.010	225.700	227.965	294.200	-0.255
IND-TX			57.592	175.500	
ACT-AGR	1.160	634.357	735.664	625.800	40.122
ACT-FOOD	1.091	331.813	361.926	320.600	9.857
ACT-CON	1.050	148.783	156.280	138.300	5.161
ACT-PETR	1.005	155.600	156.450	133.300	13.803
ACT-CHEM	1.063	119.376	126.886	115.600	8.500
ACT-MAN	0.996	133.894	133.308	142.900	3.227
ACT-CONS	0.993	133.813	132.895	162.300	-0.250
ACT-PSRV	1.075	686.687	738.372	656.200	44.358
ACT-GSRV	1.031	263.976	272.044	269.200	0.301
COM-AGRD	1.142	475.372	543.029	474.300	
COM-FOODD	1.076	334.784	360.070	326.900	
COM-COND	1.026	139.409	143.019	131.900	
COM-PETRD	0.895	104.410	93.395	92.100	
COM-CHEMD	0.995	92.442	92.014	91.000	
COM-MAND	0.968	140.659	136.088	151.200	
COM-CONSD	0.993	134.143	133.223	162.700	
COM-PSRVD	1.034	521.181	539.065	502.900	
COM-GSRVD	1.030	263.235	271.060	268.500	
COM-AGRM	1.000	15.956	15.956	12.200	
COM-FOODM	1.000	24.674	24.674	21.600	
COM-CONM	1.000	57.877	57.877	52.700	
COM-PETRM	1.000	134.287	134.287	127.500	
COM-CHEMM	1.000	67.246	67.246	66.400	
COM-MANM	1.000	171.121	171.121	188.000	
COM-PSRVM	1.000	52.910	52.910	50.200	
COM-GSRVM	1.000	9.451	9.451	9.500	
COM-AGRC	1.138	491.087	558.985	486.500	-0.241
COM-FOODC	1.071	359.372	384.743	348.500	-0.087
COM-CONC	1.018	197.266	200.896	184.600	-0.020
COM-PETRC	0.955	238.458	227.682	219.600	-0.239
COM-CHEMC	0.997	159.688	159.261	157.400	
COM-MANC	0.985	311.753	307.209	339.200	-0.028
COM-CONSC	0.993	134.143	133.223	162.700	
COM-PSRVC	1.031	574.077	591.975	553.100	-0.013
COM-GSRVC	1.029	272.685	280.511	278.000	-0.002
COM-AGRX	0.969	161.233	156.306	153.900	-40.308
COM-FOODX	0.964	40.380	38.935	36.200	-10.095
COM-CONX	0.962	21.669	20.845	18.200	-5.417
COM-PETRX	0.957	58.394	55.879	47.900	-14.599
COM-CHEMX	0.985	34.816	34.288	32.500	-8.704
COM-MANX	1.002	13.594	13.617	13.700	-3.398
COM-PSRVX	0.954	180.504	172.137	168.100	-45.126
COM-GSRVX	0.972	1.226	1.191	1.200	-0.307
RES-WRD	1.000		589.200	567.700	

**** FILE SUMMARY FOR USER ECRPP

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INPUT     KTLM     GAMS      A
OUTPUT    KTLM     LISTING   A

EXECUTION TIME       =          4.290 SECONDS
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G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1155.235	1298.468	0.890
NET INDIRECT TAXES	175.500	164.763	178.382	
INCOME EFFECT			-2.781	
FINAL USE	1461.500	1313.870	1460.015	0.900
EXPORTS	471.700	484.462	492.389	0.984
IMPORTS	-461.600	-478.334	-478.334	1.000
GDP AT MARKET PRICES	1471.600	1319.997	1474.070	0.895
TERMS OF TRADE			-7.927	
GROSS DOMESTIC INCOME	1471.600	1319.997	1466.143	
RESOURCE GAP	-10.100	-6.128	-6.128	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 10

SOLUTION TIME 7.602 SECONDS

WORK SPACE NEEDED -- 9587 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	0.970	543.400	527.001	543.400	
SLBRD	1.000	360.068	360.068	357.700	
AGL-AG	0.970	378.340	367.146	382.200	-0.003
AGL-FOD	0.989	22.522	22.264	21.800	-0.002
AGL-CON	0.986	23.650	23.330	22.900	-0.002
AGL-PTR	0.991	4.340	4.301	2.700	
AGL-CEM	0.993	12.470	12.378	12.800	
AGL-MAN	0.990	21.771	21.549	23.900	-0.001
AGL-CNS	0.989	33.702	33.323	39.100	-0.002
AGL-PSR	0.988	216.492	213.840	212.900	-0.017
AGL-GSR	0.994	190.144	188.938	182.800	-0.010
CAP-AGR	0.957	159.900	153.083	159.900	
CAP-FOOD	1.032	31.600	32.625	31.600	
CAP-CON	1.030	13.100	13.490	13.100	
CAP-PETR	1.866	5.800	10.824	5.800	
CAP-CHEM	0.942	20.800	19.596	20.800	
CAP-MAN	0.866	14.400	12.475	14.400	
CAP-CONS	0.735	7.100	5.216	7.100	
CAP-PSRV	1.016	140.400	142.601	140.400	
CAP-GSRV	1.075	1.900	2.043	1.900	
SLBRF			1.800	1.800	
CAPITALF			12.500	12.500	
ULBRT			527.001	543.400	
SLBRT			361.868	359.500	
CAPITALT			404.453	407.500	
RHSDY			590.506	635.000	
RHSDC	0.921	544.297	501.047	538.800	-0.441
UHSDY			434.217	464.700	
UHSDC	0.898	389.780	350.120	374.700	-0.757

COMPY			231.783	364.400	
GOVTY			317.755	363.000	
GOVTC	0.959	264.609	253.800	253.800	
SAV-INV	0.807	258.921	208.902	294.200	-1.210
PREMIUM			-123.789		
IND-TX			164.763	175.500	
ACT-AGR	0.956	621.335	593.812	625.800	-0.096
ACT-FOOD	0.930	324.878	302.013	320.600	-0.058
ACT-CON	0.905	141.159	127.698	138.300	-0.064
ACT-PETR	0.792	153.763	121.851	133.300	-0.808
ACT-CHEM	0.875	114.446	100.093	115.600	-0.109
ACT-MAN	0.820	134.757	110.498	142.900	-0.134
ACT-CONS	0.842	142.926	120.277	162.300	-0.117
ACT-PSRV	0.942	662.835	624.583	656.200	-0.080
ACT-GSRV	0.958	279.899	268.057	269.200	-0.003
COM-AGRD	0.945	466.933	441.224	474.300	
COM-FOODD	0.923	329.434	303.999	326.900	
COM-COND	0.892	133.268	118.940	131.900	
COM-PETRD	0.695	102.826	71.508	92.100	
COM-CHEMD	0.826	88.823	73.398	91.000	
COM-MAND	0.800	141.713	113.387	151.200	
COM-CONSD	0.842	143.278	120.573	162.700	
COM-PSRVD	0.927	505.934	469.087	502.900	
COM-GSRVD	0.958	279.173	267.370	268.500	
COM-AGRM	1.000	10.724	10.724	12.200	
COM-FOODM	1.000	22.680	22.680	21.600	
COM-CONM	1.000	55.335	55.335	52.700	
COM-PETRM	1.000	133.875	133.875	127.500	
COM-CHEMM	1.000	69.720	69.720	66.400	
COM-MANM	1.000	197.400	197.400	188.000	
COM-PSRVM	1.000	48.629	48.629	50.200	
COM-GSRVM	1.000	9.667	9.667	9.500	
COM-FOODR	0.898	22.680	20.364	21.600	
COM-CONR	0.870	55.335	48.135	52.700	
COM-PETR	0.763	133.875	102.172	127.500	
COM-CHEMR	0.740	69.720	51.579	66.400	
COM-MANR	0.674	197.400	132.971	188.000	
COM-FODR			-2.316		
COM-COR			-7.200		
COM-PER			-31.703		
COM-CEMR			-18.141		
COM-MAR			-64.429		
COM-AGRC	0.946	477.622	451.949	486.500	-0.036
COM-FOODC	0.921	352.103	324.363	348.500	-0.012
COM-CONC	0.886	188.584	167.076	184.600	-0.019
COM-PETRC	0.734	236.536	173.680	219.600	-0.165
COM-CHEMC	0.789	158.386	124.977	157.400	-0.156
COM-MANC	0.728	338.297	246.358	339.200	-0.816
COM-CONSC	0.842	143.278	120.573	162.700	
COM-PSRVC	0.934	554.498	517.716	553.100	-0.065
COM-GSRVC	0.959	288.835	277.036	278.000	-0.004
COM-AGRX	0.988	156.676	154.820	153.900	
COM-FOODX	0.982	38.223	37.537	36.200	
COM-CONX	0.982	19.755	19.398	18.200	
COM-PETRX	0.959	57.946	55.545	47.900	
COM-CHEMX	0.995	33.231	33.067	32.500	
COM-MANX	1.002	13.583	13.609	13.700	
COM-PSRVX	0.986	171.729	169.301	168.100	
COM-GSRVX	0.951	1.246	1.185	1.200	
RES-WRD	1.000		580.462	567.700	

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1447.322	1288.233	1.123
NET INDIRECT TAXES	175.500	188.487	171.449	
INCOME EFFECT			-2.375	
FINAL USE	1461.500	1622.514	1451.998	1.117
EXPORTS	471.700	457.702	449.717	1.018
IMPORTS	-461.600	-444.407	-444.407	1.000
GDP AT MARKET PRICES	1471.600	1635.809	1457.308	1.122
TERMS OF TRADE			7.985	
GROSS DOMESTIC INCOME	1471.600	1635.809	1465.293	
RESOURCE GAP	-10.100	-13.295	-13.295	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 10

SOLUTION TIME 7.407 SECONDS

WORK SPACE NEEDED -- 9587 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	1.015	543.400	551.694	543.400	
SLBRD	1.000	349.833	349.833	357.700	
AGL-AG	1.015	387.229	393.021	382.200	
AGL-FOD	1.006	20.867	20.986	21.800	
AGL-CON	1.007	21.700	21.847	22.900	
AGL-PTR	1.005	1.640	1.647	2.700	
AGL-CEM	1.004	12.916	12.964	12.800	
AGL-MAN	1.005	25.344	25.473	23.900	
AGL-CNS	1.006	42.887	43.129	39.100	
AGL-PSR	1.006	206.134	207.400	212.900	-0.004
AGL-GSR	1.003	174.507	175.059	182.800	-0.002
CAP-AGR	1.033	159.900	165.145	159.900	
CAP-FOOD	0.949	31.600	29.979	31.600	
CAP-CON	0.937	13.100	12.276	13.100	
CAP-PETR	0.517	5.800	2.996	5.800	
CAP-CHEM	1.022	20.800	21.258	20.800	
CAP-MAN	1.093	14.400	15.739	14.400	
CAP-CONS	1.210	7.100	8.590	7.100	
CAP-PSRV	0.953	140.400	133.860	140.400	
CAP-GSRV	0.914	1.900	1.737	1.900	
SLBRF			1.800	1.800	
CAPITALF			12.500	12.500	
ULBRT			551.694	543.400	
SLBRT			351.633	359.500	
CAPITALT			404.079	407.500	
RHSDY			677.900	635.000	
RHSDC	1.083	531.029	575.201	538.800	-0.376

UHSDY			495.041	464.700	
UHSDC	1.116	357.537	399.165	374.700	-0.558
COMPY			523.535	364.400	
GOVTY			416.140	363.000	
GOVTC	1.049	241.838	253.800	253.800	
SAV-INV	1.235	319.381	394.348	294.200	-1.280
PREMIUM			154.216		
IND-TX			188.487	175.500	
ACT-AGR	1.036	631.591	654.425	625.800	-0.071
ACT-FOOD	1.076	314.899	338.893	320.600	-0.058
ACT-CON	1.113	133.630	148.686	138.300	-0.066
ACT-PETR	1.393	112.728	157.051	133.300	-0.738
ACT-CHEM	1.154	115.998	133.858	115.600	-0.096
ACT-MAN	1.222	148.203	181.035	142.900	-0.091
ACT-CONS	1.208	175.408	211.882	162.300	-0.056
ACT-PSRV	1.069	643.500	687.592	656.200	-0.128
ACT-GSRV	1.051	257.107	270.289	269.200	-0.004
COM-AGRD	1.045	481.849	503.669	474.300	
COM-FOODD	1.083	322.660	349.516	326.900	
COM-COND	1.126	128.583	144.775	131.900	
COM-PETRD	1.574	80.303	126.421	92.100	
COM-CHEMD	1.210	92.406	111.833	91.000	
COM-MAND	1.244	157.531	195.988	151.200	
COM-CONSD	1.208	175.840	212.404	162.700	
COM-PSRVD	1.085	495.036	537.022	502.900	
COM-GSRVD	1.051	256.436	269.574	268.500	
COM-AGRM	1.000	13.542	13.542	12.200	
COM-FOODM	1.000	20.520	20.520	21.600	
COM-CONM	1.000	50.065	50.065	52.700	
COM-PETRM	1.000	121.125	121.125	127.500	
COM-CHEMM	1.000	63.080	63.080	66.400	
COM-MANM	1.000	178.600	178.600	188.000	
COM-PSRVM	1.000	51.468	51.468	50.200	
COM-GSRVM	1.000	9.303	9.303	9.500	
COM-FOODR	1.111	20.520	22.802	21.600	
COM-CONR	1.145	50.065	57.348	52.700	
COM-PETR	1.382	121.125	167.448	127.500	
COM-CHEMR	1.339	63.080	84.451	66.400	
COM-MANR	1.431	178.600	255.557	188.000	
COM-FODR			2.282		
COM-COR			7.283		
COM-PER			46.323		
COM-CEMR			21.371		
COM-MAR			76.957		
COM-AGRC	1.044	495.366	517.211	486.500	-0.025
COM-FOODC	1.085	343.170	372.318	348.500	-0.010
COM-CONC	1.131	178.640	202.123	184.600	-0.008
COM-PETRC	1.461	201.156	293.869	219.600	-0.272
COM-CHEMC	1.263	155.359	196.284	157.400	-0.127
COM-MANC	1.346	335.594	451.545	339.200	-0.536
COM-CONSC	1.208	175.840	212.404	162.700	
COM-PSRVC	1.077	546.430	588.490	553.100	-0.075
COM-GSRVC	1.049	265.733	278.876	278.000	-0.005
COM-AGRX	1.008	152.123	153.305	153.900	
COM-FOODX	1.020	34.146	34.817	36.200	
COM-CONX	1.022	16.500	16.863	18.200	
COM-PETRX	1.054	37.780	39.826	47.900	
COM-CHEMX	1.007	31.519	31.734	32.500	
COM-MANX	1.003	13.525	13.563	13.700	
COM-PSRVX	1.021	162.976	166.375	168.100	
COM-GSRVX	1.060	1.149	1.218	1.200	
RES-WRD	1.000		553.702	567.700	

EXECUTION TIME = 5.730 SECONDS

G D P SUMMARY

	BASE	SOLUTION CURRENT PRICES	SOLUTION CONSTANT PRICES	PRICE INDEX
GDP AT FACTOR COST	1296.100	1568.772	1339.622	1.171
NET INDIRECT TAXES	175.500	71.456	192.408	
INCOME EFFECT			-6.606	
FINAL USE	1461.500	1652.621	1516.987	1.089
EXPORTS	471.700	505.920	526.750	0.960
IMPORTS	-461.600	-518.313	-518.313	1.000
GDP AT MARKET PRICES	1471.600	1640.228	1525.424	1.075
TERMS OF TRADE			-20.830	
GROSS DOMESTIC INCOME	1471.600	1640.228	1504.594	
RESOURCE GAP	-10.100	12.393	12.393	

EXIT -- FINAL SOLUTION FOUND
TIME STEPS 6
NEWTON ITERATIONS 16

SOLUTION TIME 6.137 SECONDS

WORK SPACE NEEDED -- 7677 WORDS.
WORK SPACE AVAILABLE -- 277473 WORDS.

S O L U T I O N S U M M A R Y

	PSOL	QSOL	YSOL	YBASE	RESIDUAL
ULBRD	1.251	543.400	679.631	543.400	
SLBRD	1.000	392.399	392.399	357.700	
AGL-AG	1.245	389.048	484.451	382.200	-0.177
AGL-FOD	1.090	22.603	24.632	21.800	-0.091
AGL-CON	1.107	25.997	28.776	22.900	-0.111
AGL-PTR	1.071	3.883	4.157	2.700	-0.013
AGL-CEM	1.058	14.230	15.057	12.800	-0.033
AGL-MAN	1.080	25.597	27.655	23.900	-0.080
AGL-CNS	1.089	39.756	43.289	39.100	-0.146
AGL-PSR	1.097	236.068	258.851	212.900	-0.977
AGL-GSR	1.049	176.495	185.159	182.800	-0.495
CAP-AGR	1.275	159.900	203.882	159.900	
CAP-FOOD			37.104	31.600	
CAP-CON			15.562	13.100	
CAP-PETR			7.657	5.800	
CAP-CHEM			24.037	20.800	
CAP-MAN			15.776	14.400	
CAP-CONS	1.126	7.100	7.993	7.100	
CAP-PSRV	1.303	140.400	182.873	140.400	
CAP-GSRV	0.978	1.900	1.858	1.900	
SLBRF			1.800	1.800	
CAPITALF			12.500	12.500	
ULBRT			679.631	543.400	
SLBRT			394.199	359.500	
CAPITALT			509.243	407.500	
RHSDY			774.622	635.000	
RHSDC	1.145	574.248	657.270	538.800	-0.794

UHSDX			539.789	464.700	
UHSDC	1.076	404.545	435.246	374.700	-0.386
COMPY			449.642	364.400	
GOVTY			293.527	363.000	
GOVTC	1.048	242.190	253.800	253.800	
SAV-INV	1.041	294.200	306.305	294.200	-0.625
IND-TX			71.456	175.500	
ACT-AGR	1.233	633.678	781.596	625.800	39.032
ACT-FOOD	1.132	332.412	376.438	320.600	9.803
ACT-CON	1.046	157.002	164.290	138.300	5.520
ACT-PETR	0.918	191.705	175.990	133.300	17.397
ACT-CHEM	1.040	128.515	133.592	115.600	9.218
ACT-MAN	1.023	153.044	156.559	142.900	3.763
ACT-CONS	1.025	164.600	168.786	162.300	-0.002
ACT-PSRV	1.118	697.748	780.358	656.200	44.451
ACT-GSRV	1.051	260.008	273.143	269.200	0.295
COM-AGRD	1.232	479.877	591.248	474.300	
COM-FOODD	1.122	336.546	377.530	326.900	
COM-COND	1.023	147.263	150.715	131.900	
COM-PETRD	0.788	127.491	100.464	92.100	
COM-CHEMD	0.971	99.449	96.533	91.000	
COM-MAND	1.002	161.083	161.345	151.200	
COM-CONSD	1.025	165.006	169.202	162.700	
COM-PSRVD	1.094	531.828	581.934	502.900	
COM-GSRVD	1.050	259.278	272.153	268.500	
COM-AGRM	1.000	18.738	18.738	12.200	
COM-FOODM	1.000	26.421	26.421	21.600	
COM-CONM	1.000	60.919	60.919	52.700	
COM-PETRM	1.000	150.813	150.813	127.500	
COM-CHEMM	1.000	71.153	71.153	66.400	
COM-MANM	1.000	200.503	200.503	188.000	
COM-PSRVM	1.000	55.532	55.532	50.200	
COM-GSRVM	1.000	9.399	9.399	9.500	
COM-AGRC	1.225	497.967	609.985	486.500	-0.648
COM-FOODC	1.114	362.744	403.951	348.500	-0.223
COM-CONC	1.017	208.165	211.634	184.600	-0.017
COM-PETRC	0.907	277.034	251.277	219.600	-1.271
COM-CHEMC	0.983	170.590	167.686	157.400	-0.012
COM-MANC	1.001	361.586	361.849	339.200	
COM-CONSC	1.025	165.006	169.202	162.700	
COM-PSRVC	1.085	587.261	637.467	553.100	-0.098
COM-GSRVC	1.048	268.672	281.552	278.000	-0.005
COM-AGRX	0.990	156.228	154.672	153.900	-39.057
COM-FOODX	0.971	39.538	38.392	36.200	-9.885
COM-CONX	0.952	22.747	21.647	18.200	-5.687
COM-PETRX	0.911	72.708	66.268	47.900	-18.177
COM-CHEMX	0.969	37.534	36.352	32.500	-9.384
COM-MANX	0.975	15.330	14.952	13.700	-3.833
COM-PSRVX	0.950	181.457	172.439	168.100	-45.364
COM-GSRVX	0.991	1.208	1.197	1.200	-0.302
RES-WRD	1.000		647.033	567.700	

**** FILE SUMMARY FOR USER ECRPP

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INPUT     MODT     GAMS      A
OUTPUT    MODT     LISTING   A

EXECUTION TIME      =        5.490 SECONDS
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